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U. S. DEPARTMENT OF AGRICULTURE.

BUREAU OF PLANT INDUSTRY—BULLETIN NO. 218.

B. T. GALLOWAY, *Chief of Bureau.*

CROSSBREEDING CORN.

BY

C. P. HARTLEY, ERNEST B. BROWN, C. H. KYLE,
AND L. L. ZOOK,

Office of Corn Investigations.

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF PLANT INDUSTRY,
OFFICE OF THE CHIEF,
Washington, D. C., August 14, 1911.

SIR: I have the honor to transmit herewith and to recommend for publication as Bulletin No. 218 of the series of this Bureau a paper by C. P. Hartley, Ernest B. Brown, C. H. Kyle, and L. L. Zook, entitled "Crossbreeding Corn." This article presents one feature of the work of the Office of Corn Investigations on the project of finding and developing higher yielding strains of corn for different geographical sections of the United States. The success that is being attained along this line is due to the utilization of the effects of acclimatization, adaptation, crossbreeding, and selection.

The results of field tests in four States are given in detail. In this report the results are assembled in a manner to show the relative productiveness of first-generation crosses and their parent varieties. While these results include a part of the data that are being assembled to show the effects on corn of acclimatization and adaptation, only such mention is here made of these influences as will prevent their effects being attributed to crossbreeding.

These investigations assist in determining what varieties and what combinations of varieties can be most profitably grown in different localities. They also assist in revealing the qualities of seed corn that influence its productivity. Knowledge of this nature is especially needed at this time to assist in establishing successful methods of corn improvement embracing the good effects of selecting fine-appearing ears and of crossbreeding, without leading practical corn growers into the belief that prize-winning ears are necessarily profitable seed ears or that a well-selected and well-adapted variety is usually less productive than its first-generation cross.

The results presented here are the first results of a series of tests being conducted with many varieties under various environments. More work more accurately conducted is necessary before general conclusions of a positive nature are warranted, but the urgent need of facts concerning our most widely grown and most valuable crop makes it advisable to publish in detail these results, which are at once of both local and general value.

Respectfully,

B. T. GALLOWAY,
Chief of Bureau.

HON. JAMES WILSON,
Secretary of Agriculture.

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CROSSBREEDING CORN.

INTRODUCTION.

In the United States corn has become the leading and most universally grown crop, perhaps more because of its natural adaptability and productiveness than because of any improvement of the plant intentionally accomplished by man. Human efforts have doubtless had a great influence upon the evolution of maize, and it has been modified so as better to meet human needs. These changes, however, have come about probably more because of the interdependent relations that have existed between man and corn than through knowledge intentionally applied. The evolutionary steps that have developed the maize plant as it exists to-day are so little understood that they are of little value in indicating methods to be adopted or avoided in further improving this crop. Such improvement may rest upon a close study of the effects upon the plant of different methods of breeding and a correct application of the principles evolved.

The success of the work of the Office of Corn Investigations in originating and improving high-yielding strains of corn for different sections of the United States has been due to the utilization of the effects of acclimatization, crossbreeding, and selection. Of these three factors crossbreeding is the principal one here under consideration; but as these as well as other factors—such as seasonal and soil conditions—usually operate together in influencing plant growth, the effects of all factors that can not be eliminated must receive consideration whenever comparisons are made.

Because crossbreeding of corn is so readily accomplished, and the results are so varied and interesting, and because crossbreeding is so generally recognized as a very important process in plant improvement, the corn investigations of the Department of Agriculture during 1900 and for several years following consisted very largely in crossbreeding all types obtainable. Of the first-generation crosses tested some were unusually productive, some good, some indifferent,

and some unusually poor producers. The indifferent and poor-producing crosses were discarded and selection work started with the unusually productive ones. As the work progressed some decreased in productiveness while others retained their high-yielding qualities, and a few have come into general culture as the best grain-producing strains of certain localities.

As most of these crosses when tested in various localities were found to be seldom superior to local strains, the improvement of local strains by selection or by crossbreeding and selection combined became a more prominent feature of the corn work. This feature has proved highly satisfactory and profitable to practical farmers, and much experimental evidence has been obtained to demonstrate that strains can be greatly increased in productiveness by centgener selection.

Investigations and observations have indicated a number of lines for the improvement of general practices in seed-corn production. In this connection attention is called to the following points regarding corn: (1) That self-fertilization reduces productiveness; (2) that constant isolation, especially when unaccompanied by judicious selection, may result in the multiplication of undesirable individuals and the augmentation of their undesirable characters; (3) that the emphasis which has unfortunately been placed upon the possibility of improving productiveness by planting fine-appearing, prize-winning ears has reacted against the improvement of yields through the selection of seed from high-yielding individuals; (4) that the adaptation of the floral parts of maize to facilitate crossbreeding has played an important part in its evolution, perhaps assisting in giving it greater vigor, productiveness, adaptability, and freedom from disease than other cereals.

One or more of these features has reduced yields in so many instances where increased yields were expected that some, and especially those who have not witnessed improvement by selection, have become skeptical regarding possibility of increasing yields by selection and desirous of trying radically different methods.

Crossbred seed frequently gives better yields than either parent, especially if one or both parents are poor producers as a result of self-fertilization, inbreeding, or lack of adaptation or acclimatization. Since crossbred seed corn frequently yields less than one and sometimes less than either of the parent varieties, it would be very unwise to advise the general planting of crossbred seed without first demonstrating what varieties should be crossed in different localities to produce seed of higher yielding power than that of the best existing strains. The profits that may result from following

reliable methods and the losses that may result from following erroneous methods along these lines are tremendous because of the great extent to which corn is grown.

As acclimatization, crossbreeding, and selection have proved efficient in increasing the productiveness of corn, the question of practical importance is a determination of the best combination of these influencing factors. All these factors necessarily have a strong bearing upon the results presented in this paper. These results are presented here, however, with especial reference to the comparative productiveness of first-generation crosses and their parent varieties. In a future bulletin the results in these tests attributable to the effects of acclimatization and adaptation will be combined with results of other work and treated with especial reference to these factors and their influence upon yield.

TESTS IN MARYLAND.

WORK OF 1909.

CHOICE OF VARIETIES.

In order to make the tests of as much practical value as possible, varieties grown by successful corn growers in Maryland and adjoining States were chosen. Composite samples shelled from a hundred or more ears were used in order to equalize results of individual ear variations.

Detailed information regarding the history and description of these varieties is given in Table I, together with the germinating power of each lot of seed, both in the spring of 1909 and of 1910.

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CROSSBREEDING CORN.

TABLE I.—*Varieties of corn and first-generation crosses used in Maryland tests.*

Variety.	Parentage.	Adapted to climatic and soil conditions of—	Days to maturity.	Color and class.	Height of stalk (feet).		Germination (per cent). ¹		
					Pure variety.	First-generation cross.	Pure variety.		Crossed seed, 1910.
							1909.	1910.	
Selection:									
No. 119.....	Boone County White; a pure selection since 1880.....	{ Washington, D. C., for 10 years.	{ 120	White dent...	9.25	10.00	100.0	{ 98 100	99
No. 159.....	do.....	Auburn, Nebr., for 2 years..	120	do.....	9.00	9.00	98.0	{ 96 94	99
No. 137.....	do.....	Central Texas, for 5 years..	120	do.....	9.50	9.75	9.75	{ 83 97	98
No. 138.....	do.....	{ Murfreesboro, Tenn., for 10 years.	{ 120	do.....	9.25	9.75	95.0	{ 97 96	100
Whitesap.....	White and yellow strains mixed years ago.....	Marshallton, Del.....	120	Mixed dent...	9.25	9.00	96.5	{ 97 97	99
Ohio Learning.....	A pure selection since 1828.....	Wilmington, Ohio, since 1826.	110	Yellow dent...	8.25	8.25	99.5	{ 99 99	99
Illinois Learning.....	Selection from Ohio Learning.....	Champaign, Ill., for 25 years.	115	do.....	9.00	9.50	87.5	{ 94 96	100
Reid Yellow Dent.....	A cross; pure bred since 1847.....	East Lynn, Ill., since 1847.	115	do.....	8.75	9.00	98.5	{ 96 100	100
Sturges Hybrid Flint.....	An unstable cross of several years' selection.....	Fairfield, Conn.....	100	Yellow flint...	7.00	8.50	98.0	{ 100 85	100
Silvermine.....	Pure selection since 1890.....	Sibley, Ill., for 20 years.....	110	White dent...	8.75	9.25	86.5	{ 85 98	99
Golden Eagle.....	Pure selection since 1871.....	Toulon, Ill., since 1871.....	110	Yellow dent...	8.00	8.75	93.5	{ 98 99	99
Friley Yellow Dent.....	A local strain of no particular breeding.....	Derwood, Md., for 15 years..	120	do.....	9.50	9.75	100.0	{ 100 92	100
Selection 77.....	A cross; pure bred since 1880.....	Phleton, Ohio, since 1880..	120	White dent...	9.50	9.25	96.0	{ 87 98	97
Red Blaze.....	Somewhat variable type of Bloody Butcher since 1902.	Sullivan, Ind.....	120	Red dent.....	8.50	9.50	99.0	{ 99 100	100
No. 100.....	{ Cross of Dotson with Boone County White; pure bred since 1902.	{ Washington, D. C., since 1902.	{ 120	White dent...	9.00	9.25	98.5	{ 100 99	100
No. 120.....	{ Cross of Hickory King with Boone County White; pure bred since 1902.	{ do.....	{ 120	do.....	9.50	9.75	99.0	{ 99 96	96
Hickory King.....	A distinct and fairly pure-bred strain.....	Hickory, Va., since 1880..	125	do.....	10.00	10.00	95.0	{ 90 99	99
Selection 78.....	A pure selection of Clarge.....	Sabina, Ohio, for 12 years..	120	Yellow dent...	9.50	9.75	99.0	{ 100 99	99

¹ Of the two percentages of germination shown by means of braces in the 1910 column the lower one refers to seed of 1909; all other percentages of germination refer to original (1908) seed.

CROSSING THE VARIETIES.

Selection 119, which has been undergoing improvement for 10 years by the ear-to-row method of breeding and adaptation to conditions of the Potomac River soils near Washington, was chosen as the male-parent, and the crossed seed was obtained by planting one of the other varieties in every third row in a field of this variety located 3 miles south of Washington, D. C., on a small tributary of the Potomac. As soon as the tassels appeared they were removed from all the varieties, so that no pollen matured in the field except on the rows of Selection 119, which fertilized the silks of all the other varieties, forming the supply of crossed seed, the productiveness of which was compared in 1910 with pure seed of the parents. About 30 of the best ears from these detasseled rows were chosen as seed for these tests. These ears were shelled, making a composite sample of each cross, which was used in planting all of the tests.

A supply of the original seed of all the varieties used in making these crosses was retained in the seed-corn room of the Department of Agriculture according to the best known methods of seed preservation.

GROWING PURE-BRED SEED FOR COMPARISON.

In order that the tests of productiveness might not be restricted to the old seed of the parent varieties, isolated plats of eight of the varieties, including the male parent—Selection 119—were grown in 1909 from the original seed. These 1909 plats were grown in the same localities and under the same conditions as the original seed.

WORK OF 1910.

LOCATION OF TESTS.

Duplicate tests of productiveness were made at Derwood and at Pike Crossing, Md. Derwood is located about 16 miles northwest of Washington, where the soil is of a red-clay, flint-stone nature, and the two tests were located on similar soil. Pike Crossing is situated about 5 miles north of Washington, where the soil is of a mica, red-clay nature. At Pike Crossing the two tests adjoined, but the first test was located on land that had been in sod for some 10 years or more, while the duplicate test was located on impoverished soil that had grown truck crops for fully as many years. At these points the season of 1910 was unusually dry and unfavorable for corn.

ORDER OF PLANTING THE TEST ROWS.

In order to have the means of comparing the productiveness of the crossed seed grown in 1909 with seed of the parents grown the same season and with the original seed of the parents used in making the crosses, the plantings were made in the order shown in Table II.

It will be seen that by this order the original or 1908 seed of the two parent varieties is planted on either side of the crossed seed, and that adjoining these two rows is a row from the seed of each parent grown in 1909. In all four of the tests the varieties were planted in the same relative order.

EQUALITY OF CONDITIONS FOR GROWTH AND PRODUCTIVENESS.

Care was taken to so locate the rows that those to be compared would have equal facilities for growth and productiveness. At each location and for each test rows of uniform width were marked off both ways. Five kernels were planted in each hill and the stand thinned to two stalks to the hill. Practically a perfect stand of plants was obtained for each row of each test. Each variety and first-generation cross was thus represented by the same number of plants, occupying the same number of square feet of adjacent, apparently similar, soil.

PRESENTATION OF RESULTS IN MARYLAND.

FIELD RECORDS IN DETAIL.

Table II presents full details of both the original and the duplicate test at Derwood and of like tests at Pike Crossing. The order of occurrence of the varieties in the table is the same as in the test plats.

TABLE II.—*Tests of parent varieties and first-generation crosses of corn.*

AT DERWOOD, MD.¹

Field row No.	Variety and cross.	First test.						Duplicate test.					
		Number of stalks.	Yield.					Number of stalks.	Yield.				
			Ears.	Increase over male parent.	Number of ears.		Stover.		Ears.	Increase over male parent.	Number of ears.		Stover.
					Good.	Poor.					Good.	Poor.	
			Lbs.	P. ct.			Lbs.		Lbs.	P. ct.			Lbs.
10	Selection 119, 1909.....	100	53	.....	35	45	52	100	70	.....	65	28	65
11	Selection 159, 1909.....	100	53	.....	40	51	47	98	66	.....	60	30	80
12	Selection 159, original.....	100	64	.....	45	59	51	100	71	.....	60	36	61
13	Selection 159×Selection 119.....	100	56	— 3	20	71	61	102	71	1	60	41	60
14	Selection 119, original.....	100	60	.....	40	56	61	99	66	.....	65	31	63
15	Selection 119, 1909.....	100	63	.....	50	45	59	100	71	.....	63	34	61
16	Selection 137, 1909.....	100	58	.....	35	56	67	98	60	.....	55	37	66
17	Selection 137, original.....	97	56	.....	40	43	62	100	63	.....	60	37	61
18	Selection 137×Selection 119.....	101	67	8	40	60	67	100	75	6	65	33	72
19	Selection 119, original.....	100	56	.....	45	43	62	98	64	.....	50	45	64
20	Selection 119, 1909.....	99	61	.....	35	57	59	100	70	.....	65	29	60
21	Selection 138, 1909.....	100	47	.....	26	69	71	100	51	.....	45	42	74
22	Selection 138, original.....	100	47	.....	20	70	66	99	60	.....	50	45	68
23	Selection 138×Selection 119.....	100	58	— 9	50	54	74	100	68	0	60	38	69
24	Selection 119, original.....	100	60	.....	30	62	61	99	55	.....	45	41	59
25	Selection 119, 1909.....	100	67	.....	57	39	57	100	66	.....	58	43	58

¹ Length of row 164 feet.

TABLE II.—*Test of parent varieties and first-generation crosses of corn*—Continued.

AT DEERWOOD, MD.—Continued.

Field row No.	Variety and cross.	First test.						Duplicate test.					
		Number of stalks.	Yield.					Number of stalks.	Yield.				
			Ears.	Increase over male parent.	Number of ears.		Stover.		Ears.	Increase over male parent.	Number of ears.		Stover.
					Good.	Poor.					Good.	Poor.	
			Lbs.	P. ct.			Lbs.		Lbs.	P. ct.			Lbs.
26	Selection 119×Selection 119.	100	60	—10	60	64	51	101	66	—3	50	45	62
27	Selection 119, original.	99	58	.....	20	74	54	100	70	.....	60	34	63
28	Whitecap, original.	100	49	.....	35	63	49	100	53	.....	40	54	58
29	Whitecap×Selection 119.	100	58	—13	30	70	55	100	72	6	60	39	72
30	Selection 119, original.	100	54	.....	54	60	53	99	63	.....	55	39	55
31	Selection 119, 1909.	100	66	.....	50	47	49	100	70	.....	60	36	56
32	Ohio Leaming, original.	100	46	.....	26	63	27	100	50	.....	50	33	31
33	Ohio Leaming×Selection 119.	100	56	—8	35	70	35	100	74	17	70	30	41
34	Selection 119, original.	100	56	.....	32	65	53	97	69	.....	50	47	50
35	Selection 119, 1909.	98	56	.....	25	64	53	100	56	.....	65	39	43
36	Illinois Leaming, original.	100	46	.....	41	52	35	101	46	.....	50	38	34
37	Illinois Leaming×Selection 119.	99	58	—1	59	55	47	100	55	—7	45	52	42
38	Selection 119, original.	98	48	.....	35	63	52	100	54	.....	45	54	50
39	Selection 119, 1909.	99	61	.....	46	48	58	100	62	.....	60	39	48
40	Reid Yellow Dent, original.	99	50	.....	47	46	39	101	49	.....	56	29	29
41	Reid Yellow Dent×Selection 119.	99	61	—6	45	56	50	99	60	3	60	43	49
42	Selection 119, original.	99	50	.....	45	49	61	99	56	.....	50	52	57
43	Selection 119, 1909.	101	69	.....	50	51	62	101	55	.....	55	39	44
44	Sturges Hybrid Flint, original.	100	34	.....	22	76	33	106	30	.....	40	52	26
45	Sturges Hybrid Flint×Selection 119.	100	58	—11	62	45	49	100	44	—11	40	56	35
46	Selection 119, original.	99	60	.....	40	62	69	99	44	.....	20	60	37
47	Selection 119, 1909.	100	62	.....	40	57	60	99	44	.....	30	64	45
48	Silvermine, original.	100	50	.....	25	62	37	101	41	.....	33	43	34
49	Silvermine×Selection 119.	100	57	—11	20	77	47	100	54	—4	47	40	44
50	Selection 119, 1909.	98	66	.....	43	52	64	98	69	.....	50	47	56
51	Golden Eagle, original.	100	43	.....	25	75	30	100	45	.....	48	41	36
52	Golden Eagle×Selection 119.	98	60	—7	35	64	45	100	57	—10	45	55	44
53	Selection 119, 1909.	100	63	.....	45	53	62	101	58	.....	52	43	49
54	Fraley Yellow Dent, original.	100	59	.....	45	54	64	99	59	.....	55	45	54
55	Fraley Yellow Dent×Selection 119.	98	59	0	43	63	56	100	60	0	50	40	68
56	Selection 119, 1909.	100	55	.....	35	61	55	99	62	.....	54	42	49
57	Selection 77, 1909.	100	53	.....	30	66	48	100	59	.....	55	45	58
58	Selection 77, original.	100	48	.....	30	65	47	101	64	.....	55	42	53
59	Selection 77×Selection 119.	100	55	—5	25	70	48	97	58	—7	40	55	53
60	Selection 119, 1909.	100	61	.....	40	45	57	100	63	.....	50	48	56
61	Red Blaze, original.	97	46	.....	55	37	34	100	51	.....	70	28	38
62	Red Blaze×Selection 119.	100	59	—9	43	52	45	98	65	5	65	36	50
63	Selection 119, 1909.	100	69	.....	75	25	57	100	61	.....	50	48	51
64	Cross 100, 1909.	99	53	.....	45	48	58	99	47	.....	50	43	55
65	Cross 100, original.	100	44	.....	40	55	48	100	41	.....	40	45	48
66	Cross 100×Selection 119.	100	51	—14	30	65	51	98	60	0	60	45	52
67	Selection 119, 1909.	101	49	.....	35	61	48	100	59	.....	45	53	50
68	Cross 120, 1909.	100	55	.....	50	46	49	100	63	.....	74	25	57
69	Cross 120, original.	99	57	.....	37	60	49	99	61	.....	45	50	56
70	Cross 120×Selection 119.	100	62	18	29	65	52	99	74	27	57	45	69
71	Selection 119, 1909.	100	56	.....	40	60	52	98	58	.....	45	47	53
72	Hickory King, original.	100	51	.....	55	51	78	100	60	.....	60	29	48

¹ Unreliable, as this row occupied the dead furrow.

TABLE II.—Tests of parent varieties and first-generation crosses of corn—Continued.

AT DERWOOD, MD.—Continued.

Field row No.	Variety and cross.	First test.						Duplicate test.					
		Number of stalks.	Yield.					Number of stalks.	Yield.				
			Ears.	Increase over male parent.	Number of ears.		Stover.		Ears.	Increase over male parent.	Number of ears.		Stover.
					Good.	Poor.					Good.	Poor.	
73	Hickory King×Selection 119.....	101	Lbs. 63	P. ct. 7	52	50	Lbs. 79	100	Lbs. 74	P. ct. 21	77	24	Lbs. 83
74	Selection 119, 1909.....	100	62	.....	30	74	59	99	64	.....	48	47	59
75	Selection 78, 1909.....	100	55	.....	35	62	50	99	58	.....	54	41	51
76	Selection 78, original.....	99	58	.....	35	77	48	99	70	.....	60	37	55
77	Selection 78 × Selection 119.....	99	58	— 5	20	80	56	99	70	4	60	41	67
78	Selection 119, 1909.....	100	60	.....	38	64	60	99	70	.....	50	47	65

AT PIKE CROSSING, MD.¹

3	Selection 159, original.	By mistake this row was cut.												35
4	Selection 159×Selection 119.....	82	40	—20	32	42	39	79	11	0	0	46	34	34
5	Selection 119, original.	80	48	.....	47	32	39	82	10	.....	0	39	35	35
6	Selection 119, 1909.....	79	50	.....	51	24	40	82	11	.....	0	50	37	37
7	Selection 137, original.	81	42	.....	32	36	40	79	5½	.....	0	27	31	31
8	Selection 137×Selection 119.....	82	50	2	47	32	46	76	6	—44	0	30	26	26
9	Selection 119, original.	78	44	.....	40	34	45	86	7½	.....	0	39	31	31
10	Selection 119, 1909.....	82	48	.....	48	30	42	82	10½	.....	1	51	32	32
11	Selection 138, original.	76	36	.....	29	38	48	80	4½	.....	0	24	32	32
12	Selection 138×Selection 119.....	85	55	16	54	27	61	82	5½	—49	0	25	43	43
13	Selection 119, original.	79	42	.....	36	35	48	80	7½	.....	0	33	33	33
14	Selection 119, 1909.....	86	47	.....	45	36	46	77	11	.....	0	48	34	34
15	Selection 119×Selection 119.....	80	44	—12	43	31	42	76	7	—45	0	33	35	35
16	Selection 119, original.	80	43	.....	39	37	43	79	8½	.....	1	38	36	36
17	Whitecap, original.....	80	39	.....	40	26	42	77	4	.....	0	21	29	29
18	Whitecap×Selection 119.....	84	48	— 4	43	33	49	81	5	—61	0	26	39	39
19	Selection 119, original.	85	47	.....	44	34	45	79	6½	.....	0	36	35	35
20	Selection 119, 1909.....	83	53	.....	47	32	50	82	14½	.....	1	51	37	37
21	Ohio Leaming, original.....	81	36	.....	31	48	25	81	8	.....	1	43	21	21
22	Ohio Leaming×Selection 119.....	83	45	—16	48	29	34	80	9	—36	0	46	27	27
23	Selection 119, original.	80	54	.....	48	28	48	81	12½	.....	2	49	38	38
24	Selection 119, 1909.....	81	54	.....	50	29	50	80	13½	.....	0	54	37	37
25	Illinois Leaming, original.....	78	43	.....	51	28	33	82	7	.....	0	41	30	30
26	Illinois Leaming×Selection 119.....	83	47	—12	52	22	50	82	8	—44	0	43	39	39
27	Selection 119, original.	79	52	.....	52	24	47	81	9½	.....	0	41	41	41
28	Selection 119, 1909.....	81	53	.....	52	24	57	79	15	.....	0	59	35	35
29	Raid Yellow Dent, original.....	80	36	.....	38	36	32	78	6½	.....	0	38	26	26
30	Raid Yellow Dent×Selection 119.....	82	49	— 7	54	24	45	81	12½	—27	0	59	36	36
31	Selection 119, original.	82	51	.....	44	32	49	81	12½	.....	0	48	41	41
32	Selection 119, 1909.....	82	52	.....	47	28	54	81	20	.....	0	65	39	39
33	Sturges Hybrid Flint, original.....	85	32	.....	44	33	27	81	7	.....	0	36	26	26
34	Sturges Hybrid Flint×Selection 119.....	82	49	— 1	56	20	41	82	19	—15	10	50	37	37
35	Selection 119, original.	82	49	.....	55	21	45	80	21	.....	2	54	46	46
36	Selection 119, 1909.....	83	47	.....	36	39	49	77	24½	.....	4	57	41	41
37	Silvermine, original.....	77	32	.....	20	52	46	73	14½	.....	0	55	24	24
38	Silvermine×Selection 119.....	86	40	—20	33	37	39	82	14½	—12	0	58	37	37
39	Selection 119, original.	79	50	.....	44	32	48	79	7	.....	0	32	46	46
40	Selection 119, 1909.....	82	53	.....	48	31	52	81	8½	.....	0	40	42	42

¹ Length of row 135 feet.

TABLE II.—*Tests of parent varieties and first-generation crosses of corn*—Continued.

AT PIKE CROSSING, MD.—Continued.

Field row No.	Variety and cross.	First test.						Duplicate test.					
		Number of stalks.	Yield.					Number of stalks.	Yield.				
			Ears.	Increase over male parent.	Number of ears.		Stover.		Ears.	Increase over male parent.	Number of ears.		Stover.
					Good.	Poor.					Good.	Poor.	
			Lbs.	P. ct.			Lbs.		Lbs.	P. ct.			Lbs.
41	Golden Eagle, original.	74	26	.....	20	46	25	81	24	.....	0	20	21
42	Golden Eagle×Selection 119.....	78	45	— 8	26	46	36	84	64	— 21	0	39	32
43	Selection 119, original.	74	45	.....	40	28	45	80	74	.....	0	34	43
44	Selection 119, 1909.....	78	45	.....	44	28	46	80	84	.....	0	39	46
45	Fraley Yellow Dent, original.....	79	50	.....	48	27	53	82	5	.....	0	29	46
46	Fraley Yellow Dent×Selection 119.....	77	44	— 10	40	25	53	84	94	12	1	44	54
47	Selection 119, original.	79	50	.....	47	28	55	81	84	.....	0	44	49
48	Selection 119, 1909.....	77	53	.....	48	28	58	81	12	.....	0	58	51
49	Selection 77, original.....	77	48	.....	40	32	50	82	64	.....	0	40	42
50	Selection 77 × Selection 119.....	71	46	— 13	41	21	48	82	8	— 20	0	44	48
51	Selection 119, original.	78	52	.....	40	34	56	81	8	.....	0	42	52
52	Selection 119, 1909.....	79	53	.....	44	29	59	82	84	.....	0	42	49
53	Red Blaze, original.....	79	44	.....	52	20	44	81	6	.....	0	37	29
54	Red Blaze×Selection 119.....	73	48	— 9	52	18	45	81	74	— 20	0	42	44
55	Selection 119, original.	78	55	.....	48	24	54	82	104	.....	1	50	48
56	Selection 119, 1909.....	73	52	.....	52	16	58	82	124	.....	1	51	48
57	Cross 100, original.....	80	40	.....	40	24	49	82	44	.....	2	16	44
58	Cross 100 × Selection 119.....	71	48	— 14	48	17	50	81	10	— 31	4	35	55
59	Selection 119, original.	72	52	.....	52	17	50	82	164	.....	4	45	50
60	Selection 119, 1909.....	82	60	.....	52	24	51	82	18	.....	5	45	57
61	Cross 120, original.....	65	43	.....	38	24	48	81	174	.....	10	36	44
62	Cross 120 × Selection 119.....	77	58	12	60	12	57	82	204	22	10	42	56
63	Selection 119, original.	82	53	.....	45	38	47	82	154	.....	6	46	53
64	Selection 119, 1909.....	80	44	.....	36	37	51	80	17	.....	6	39	53
65	Hickory King, original.....	68	35	.....	44	20	56	80	18	.....	12	45	47
66	Hickory King×Selection 119.....	75	49	10	58	14	51	83	174	6	6	40	54
67	Selection 119, original.	75	42	.....	28	37	51	80	164	.....	3	49	50
68	Selection 119, 1909.....	80	45	.....	36	40	48	80	134	.....	5	33	48
69	Selection 78, original.....	77	33	.....	24	39	33	83	94	.....	0	34	36
70	Selection 78 × Selection 119.....	82	42	2	32	38	36	81	144	11	4	41	42
71	Selection 119, original.	80	37	.....	20	46	46	81	12	.....	1	41	45
72	Selection 119, 1909.....	81	37	.....	23	43	46	79	15	.....	6	39	41

1 1909 seed substituted for original seed.

Table II shows the usual inexplicable variations of test-plot work. Especially do such variations occur in the duplicate planting at Pike Crossing where the soil was so deplete of humus that from a financial standpoint the crop was a failure. Under these very adverse conditions it is rather surprising that the results accord with those of the other three tests as well as they do.

COMPARATIVE PRODUCTIVENESS OF SEEDS OF 1908 AND 1909.

Table II shows 42 instances in which the 1908 seed and 1909 seed of the male parent were planted in adjacent rows. In 33 of these 42 instances the 1909 seed produced the better, in five the 1908

seed produced the better, and in four the yield was the same. The 1908 seed produced 1,797 pounds of ears and the 1909 seed produced 1,938 pounds, a decreased yield of 7 per cent, due, perhaps, to the poor development or loss of vigor of the 1908 seed. The 1909 seed was grown from the 1908 seed under conditions that prevented any crossing with other varieties. Its greater productiveness therefore can not be attributed to mixture with other varieties.

While the 1908 seed of Selection 119 produced 7 per cent less than its progeny seed grown in 1909, it is not certain that the age of the 1908 seed was the cause of the decreased productiveness as the seed germinated perfectly the spring following its maturity, and also showed a germination of 98 per cent in the spring of 1910. The 1909 seed showed a germination of 100 per cent in the spring of 1910.

A comparison of the productiveness of the 1908 and 1909 seed of the female parents shows sufficient instances in which the 1908 seed produced better than the 1909 seed to make the average production of the 1908 seed equal to that of the 1909 seed.

CROSSES COMPARED IN PRODUCTIVENESS WITH THE MALE PARENT.

In computing the per cent of increased yield over the male parent in Table II the seed of the male parent grown the same year the crossing was accomplished is considered. As none of the female parents consistently produced better than the male parent, the male parent of all the crosses, Selection 119, is taken as the basis with which to compare the crosses. In all cases the average yield of two rows, the nearest one on either side of the cross, is compared with the cross.

Considering that contradictory results from any of the four tests is sufficient cause for ignoring all four of the tests, we have remaining five crosses which produced uniformly less than their male parent, and two comparisons in which the cross uniformly produced better than either parent.

The five first-generation crosses ($\times$ Selection 119) that uniformly produced less than the better of the two parents are Illinois Leaming, Sturges Hybrid Flint, Silvermine, Golden Eagle, and Selection 77.

The two first-generation crosses ($\times$ Selection 119) that uniformly produced better than either parent are Cross 120 and Hickory King.

COMBINED RESULTS OF THE FOUR MARYLAND TESTS.

In Table III the four separate Maryland tests are combined. In the Derwood test some of the female-parent varieties were represented by both 1908 and 1909 seed. In such instances the average of the two has been used. In these combined results this comparison of the crosses with the better yielding of the two parents is a straight comparison of the crosses with their male parent, for it is more pro-

ductive than any of the female parents except Fraley Yellow Dent, which it equals.

TABLE III.—Productiveness of first-generation crosses of corn compared with that of the better parent, 1909 seed of the male parent being considered.

Row No.	Variety and cross.	Number of stalks. ¹	Grain yield.		Stover yield.		Moisture in shelled grain when ears were weighed.	Water-free basis.	
			Ears.	Increase over better parent.	Weight.	Increase over heavier stover-producing parent.		Ears.	Increase over better parent.
			Pounds.	P. ct.	Pounds.	P. ct.	P. ct.	Pounds.	P. ct.
1	Selection 159 × Selection 119.	363	178	- 9	194	- 2	31.4	122.1	-12
3	Selection 119, 1909.....	361	195	.....	197	.....	28.8	138.8	.....
4	Selection 137.....	358	187	.....	200	.....	28.5	119.4	.....
5	Selection 137 × Selection 119.	359	198	3	211	6	30.0	138.6	1
7	Selection 119, 1909.....	363	190	.....	193	.....	28.8	135.3	.....
8	Selection 138.....	356	144	.....	220	.....	30.2	100.5	.....
9	Selection 138 × Selection 119.	367	187	- 2	247	12	31.9	127.4	- 6
11	Selection 119, 1909.....	363	191	.....	192	.....	28.8	136.0	.....
12	Selection 119 × Selection 119.	357	177	-10	190	- 1	28.8	126.1	-10
14	Whitcap, original.....	357	145	.....	178	.....	27.2	105.6	.....
15	Whitcap × Selection 119....	365	183	- 7	215	12	27.7	132.3	- 6
17	Selection 119, 1909.....	365	204	.....	192	.....	28.8	145.3	.....
18	Ohio Leaming, original.....	362	140	.....	104	.....	22.1	109.1	.....
19	Ohio Leaming × Selection 119.....	363	184	- 4	137	-27	22.2	143.1	5
21	Selection 119, 1909.....	359	180	.....	183	.....	28.8	128.2	.....
22	Illinois Leaming, original.....	361	142	.....	132	.....	27.6	102.8	.....
23	Illinois Leaming × Selection 119.....	364	168	- 9	178	- 7	26.7	123.1	- 7
25	Selection 119, 1909.....	359	191	.....	198	.....	28.8	136.0	.....
26	Reid Yellow Dent, original.....	358	142	.....	126	.....	24.8	106.7	.....
27	Reid Yellow Dent × Selection 119.....	361	183	- 5	180	- 9	26.3	134.8	- 2
29	Selection 119, 1909.....	365	196	.....	199	.....	28.8	139.6	.....
30	Sturges Hybrid Flint, original.....	372	103	.....	112	.....	19.9	82.5	.....
31	Sturges Hybrid Flint × Selection 119.....	364	170	- 9	162	-18	25.5	126.7	- 5
32	Selection 119, 1909.....	359	178	.....	195	.....	28.8	126.8	.....
33	Silvermine, original.....	361	138	.....	141	.....	23.8	105.2	.....
34	Silvermine × Selection 119.....	368	166	-11	167	-18	27.6	120.2	-10
35	Selection 119, 1909.....	359	197	.....	214	.....	28.8	140.3	.....
36	Golden Eagle, original.....	355	117	.....	112	.....	25.6	87.0	.....
37	Golden Eagle × Selection 119.	360	169	- 9	157	-25	25.5	125.9	- 5
38	Selection 119, 1909.....	359	175	.....	203	.....	28.8	124.6	.....
39	Fraley Yellow Dent, original.....	360	173	.....	217	.....	27.2	125.9	.....
40	Fraley Yellow Dent × Selection 119.....	359	173	- 3	231	6	29.2	122.4	- 3
41	Selection 119, 1909.....	357	180	.....	212	.....	28.8	128.2	.....
42	Selection 77.....	360	168	.....	195	.....	30.7	116.4	.....
43	Selection 77 × Selection 119..	350	167	- 9	197	- 9	30.0	116.9	-10
44	Selection 119, 1909.....	361	186	.....	223	.....	28.8	132.5	.....
45	Red Blaze, original.....	357	147	.....	145	.....	26.0	108.8	.....
46	Red Blaze × Selection 119....	352	180	- 5	184	-16	27.4	130.7	- 3
47	Selection 119, 1909.....	355	193	.....	214	.....	28.8	137.4	.....
48	Cross 100.....	361	138	.....	198	.....	27.4	100.2	.....
49	Cross 100 × Selection 119.....	350	169	-11	208	- 0.2	29.3	119.5	-11
50	Selection 119, 1909.....	365	185	.....	203	.....	28.8	131.7	.....
51	Cross 120.....	345	179	.....	198	.....	32.2	121.4	.....
52	Cross 120 × Selection 119.....	358	215	20	234	14	29.2	152.2	19
53	Selection 119, 1909.....	359	174	.....	209	.....	28.8	123.9	.....
54	Hickory King, original.....	348	164	.....	265	.....	33.7	108.7	.....
55	Hickory King × Selection 119.....	359	204	13	267	1	32.0	138.7	8
56	Selection 119, 1909.....	359	186	.....	215	.....	28.8	132.5	.....
57	Selection 78.....	359	163	.....	171	.....	28.1	117.2	.....
58	Selection 78 × Selection 119..	361	184	0.3	201	- 6	29.8	129.3	- 1
59	Selection 119, 1909.....	360	181	.....	214	.....	28.8	128.9	.....

¹ Length of row 598 feet.

Eleven of the fourteen crosses of distinct varieties produced less grain than the better yielding of the two parents. When the pounds of ears harvested is reduced to a water-free basis, according to the percentage of water in the shelled grain at harvest time, the general results remain the same, namely, 11 comparisons in which the first-generation cross produced less and 3 in which it produced more than the better yielding of the two parents.

In Table IV those crosses which produced better than either parent are classed as advantageous. The others are classed as disadvantageous.

TABLE IV.—*First-generation crosses of corn (male parent, Selection 119), showing pounds of grain produced (water-free basis) and classified as advantageous and disadvantageous.*

Female parent and classification.	Yield.			
	Of parent.		Of cross.	Increase over better parent.
	Female.	Male.		
Disadvantageous—Crosses less productive than the better parent:	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Per cent.</i>
Whitecap.....	106	141	132	— 6
Illinois Leaming.....	103	132	123	— 7
Reid Yellow Dent.....	107	138	135	— 2
Sturges Hybrid Flint.....	83	133	127	— 5
Silvermine.....	105	134	120	—10
Golden Eagle.....	87	132	126	— 5
Fraley Yellow Dent.....	126	126	122	— 3
Selection 77.....	116	130	117	—10
Red Blaze.....	109	135	131	— 3
Cross 100.....	100	135	120	—11
Selection 78.....	117	131	129	— 1
Average.....	105	133	126	— 6
Advantageous—Crosses more productive than the better parent:				
Ohio Leaming.....	109	137	143	5
Cross 120.....	121	128	152	19
Hickory King.....	109	128	139	8
Average.....	113	131	145	10

ADVANTAGEOUS CROSSES.

Without consideration of water content the Ohio Leaming cross would be a disadvantageous cross, but the dryness of the ears, due doubtless in some degree to the earliness of the female parent, causes it to fall into the class of advantageous crosses with an increased yield of 5 per cent over Selection 119. A cross made in 1900 in which this strain of Leaming was used as male parent also produced dry and unusually solid ears.

Cross 120 was originated in 1902 by planting occasional rows of Hickory King in a field of Selection 119. All Hickory King stalks were detasseled. Since 1902 Cross 120 and Selection 119 have been improved in yield and adapted to climatic and soil conditions near Washington, D. C., by yearly growing ear-to-row breeding plats and saving seed from the best stalks of the highest yielding rows.

It is of especial interest that these two improved, acclimated, and related strains when crossed in 1909 should give a first-generation cross of much greater yielding power than either parent. This first-generation cross produced better than any of the other first-generation crosses and better than any of the other varieties tested. It is the only cross that produced far better than either parent in all four tests. By these tests the value of the seed of this particular first-generation cross for the conditions prevailing at these points in Maryland in 1910 has been demonstrated. These two strains are now being crossed extensively in producing seed for general planting. This cross-pollinated seed is designated "First-Generation Cross No. 182."

The third and last advantageous cross of the 14 crosses, as classified in Table IV, is the same cross that gave origin to Cross 120, which, after six years of selection and adaptation, produces somewhat less than the first-generation cross of the same parents made in 1909, after each parent has undergone six years of selection and adaptation. This fact indicates that it is more profitable to acclimate and improve the parents of an advantageous cross separately and cross them yearly to obtain seed than to cross them once and then rely upon the acclimatization and improvement of the cross. Furthermore, since Cross 120, after six years of improvement, when crossed with Selection 119 gives a first-generation cross of superior productiveness, it would seem that the recrossing of a cross sometimes gives better seed than the crossing of the original pure-bred varieties. The advantage may be due to adaptation, as one of the original parents, Hickory King, has not been adapted to conditions near Washington, D. C.

DISADVANTAGEOUS CROSSES.

The Whitecap variety is adapted to conditions in Delaware, where it is quite extensively grown. It yields a very large ear, with a large cob, and yellow kernels with white caps. Neither in weight of ears as harvested nor on a water-free basis did the first generation cross of Whitecap and Selection 119 produce as well as the male parent.

The Illinois Leaming, though a pure selection from the Ohio Leaming, is now very unlike it in appearance. The Illinois Leaming is of a rougher type, with broader kernels. According to pounds of ears at harvest the crosses of the two strains of Leaming with Selection 119 fell below the male parent in production. The Illinois Leaming cross did not produce as well as the Ohio Leaming cross, and the grain contained more water at harvest time. Making the comparison of yields on a water-free basis the Ohio Leaming cross is advantageous and the Illinois Leaming cross is disadvantageous.

Sturges Hybrid Flint, the only flint variety used in these experiments, is a large-eared yellow corn adapted to Connecticut conditions. It has stalks considerably shorter than those of the male parent and is 20 days earlier. The cross was intermediate between the two parents in size and time of maturity. The first-generation cross produced much better than the female parent, but not quite as well as the male parent.

Silvermine, a white dent, and Golden Eagle, a yellow dent, are the earliest varieties used in these experiments except Sturges Hybrid Flint. Their first-generation crosses with Selection 119 produced much better than the female parents, but not quite as well as the male parent. In comparison with the results from this same seed as tested in California (discussed later) it should be noted here that, while in Maryland Silvermine is but an average producer and Golden Eagle is second to the poorest of all the varieties, under California conditions both these varieties rank very high in production.

Fraley Yellow Dent is the variety that for 15 years has been grown on the Derwood farm on which two of these four tests were made. It is a productive variety adapted to the conditions at Derwood and unrelated to Selection 119. Among the 14 first-generation crosses tested this is the only instance in which both parents are more productive than the first-generation cross. The 1908 seed of the female parent produced slightly better than the cross. Except that Fraley Yellow Dent differs in color from the male parent and has not been improved by ear-to-row selection, the conditions of this disadvantageous cross are similar to those of the most advantageous cross of the series, both parents being well adapted to climatic and soil conditions and highly productive.

Selection 77 resembles Cross 120 and like it has undergone many years of selection. Cross 120 is adapted to Maryland conditions, and Selection 77 to Scioto River Valley conditions in Ohio. With Selection 119 as male parent Cross 120 makes a highly advantageous cross and Selection 77 a disadvantageous cross.

Cross 100 was made at the same time (1902) and in the same manner as Cross 120, Boone County White being the male parent in each case. Hickory King, a broad-kerneled small-cobbed corn, was female parent of Cross 120, and Dotson, a long-kerneled, small-eared, small-cobbed corn, was female parent of Cross 100. The two crosses have had similar ear-to-row selection since 1902. Cross 100 has yearly been grown on poorer soil than has Cross 120. Although of such similar history and treatment, when these crosses are crossed with the related variety, Boone County White, one

makes a highly advantageous first-generation cross and the other a disadvantageous first-generation cross.

Of all the varieties used as female parents, the most productive and the seven least productive formed disadvantageous first-generation crosses with Selection 119.

COMPARISON OF FIRST-GENERATION CROSSES WITH THE 1908 SEED OF BOTH
PARENTS.

Although placing the odds in favor of the crosses, a comparison is here made between the productiveness of first-generation crosses and that of the parents as grown from the original (1908) seed.

There are 31 instances in which the first-generation cross occupied a row between rows of either parent in which the 2-year-old seed was planted. In these 31 comparisons the cross exceeds the better of the two parents in 14, equals it in 1, and produces less in 16. Of these 16 cases the male parent exceeds the cross in 15 and the female parent (the Fraley Yellow Dent variety) once.

It should be noted here that if these Maryland tests had been restricted to the original seed of the parents, as has been done in a few reported tests of this nature, the first-generation crosses would have stood much higher in production in comparison with the parent varieties.

RELATIVE GRAIN PRODUCTION OF PARENT VARIETIES AND FIRST-GENERATION
CROSSES.

Expressed in terms of bushels per acre, allowing 70 pounds of ears containing 15 per cent of moisture to the bushel, the parents and crosses rank as follows for the four tests combined:

Male parent, 1909 seed.....	49
First-generation crosses, 1909 seed.....	47
Male parent, 1908 seed.....	45
Female parents, mostly 1908 seed.....	39

This relative production is shown in figure 1. As the yield for each field row shown in the diagram is the combined yield of a row from each of the four tests, the curves show the relative production of the different lots of seed with fluctuating variations and variations due to soil conditions somewhat reduced.

The four Maryland tests show the production of the crosses in general to be much above the average for the parents and somewhat below the male parent. Of the 14 crosses between distinct strains the cross of Cross 120 with Selection 119 is the only one that is remarkably superior to Selection 119 for the soil and climatic conditions under which the tests were conducted. The increased

productiveness of this cross seems sufficient to warrant the crossing of these two strains in producing seed for general use in Maryland and Virginia, where conditions similar to those of the tests exist.

As 1909 seed of the male parent occupied every third or fourth row in all four of the tests, a check or standard is afforded for comparing the productiveness of all the varieties and crosses. In Table V the varieties and first-generation crosses are classified and arranged in separate columns in the order of their productiveness, the most productive being mentioned first and ranked as 1. In computing the comparative productiveness of the varieties and crosses for this table the yield of a variety is decreased or increased proportionately

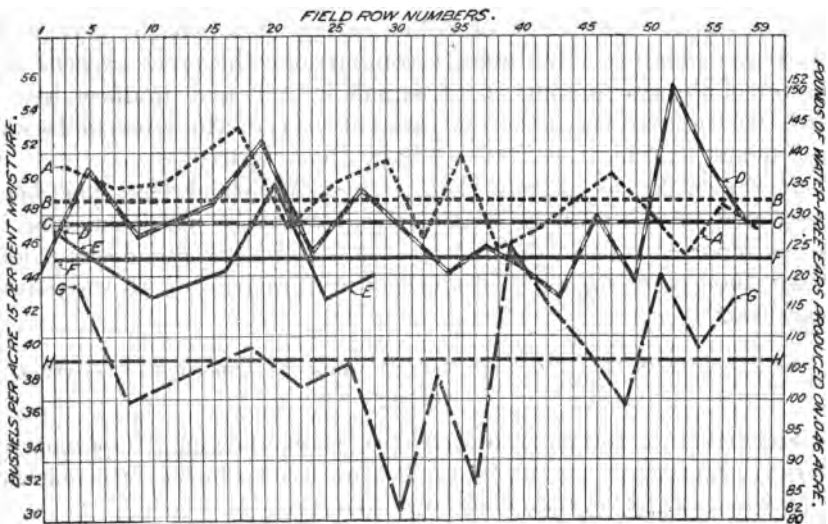


FIG. 1.—Diagram showing the relative production of parent varieties of corn and their first-generation crosses in Maryland, 1910: A, Male parent, variation of 1909 seed; B, male parent, mean of 1909 seed; C, mean of crosses; D, variation of crosses; E, male parent, variation of 1908 seed; F, male parent, mean of 1908 seed; G, variation of female parents; H, mean of female parents.

as the average yield of the two nearest rows of Selection 119 exceeds or falls short of the general average of Selection 119 for all rows in all the tests.

From the seven best female parents the crosses of six are found among the seven best crosses, Selection 77 being the only high-producing variety whose cross is a poor producer. Along with this indication that the productiveness of the parents influences the productiveness of the cross there are sufficient exceptions to indicate that the productiveness of a first-generation cross is sometimes determined to a great degree by other factors.

TABLE V.—*Parent varieties and crosses classified and ranked according to the computed production of ear corn (basis of 15 per cent moisture).*

Rank.	First-generation cross (× Selection 119).	Parent variety.	Yield per acre.
			<i>Bushels.</i>
1	Cross 120.....		58
2	Hickory King.....		53
3	Ohio Leaming.....		51
4		Selection 119 (average for 60 rows).....	49
5		Fraley Yellow Dent.....	48
6	Selection 78.....		48
7	Reid Yellow Dent.....		47
8	Fraley Yellow Dent.....		47
9	Red Blaze.....		47
10	Sturges Hybrid Flint.....		46
11	Golden Eagle.....		46
12		Cross 120.....	46
13	Whitecap.....		46
14	Illinois Leaming.....		45
15	Silvermine.....		44
16	Selection 77.....		44
17		Selection 78.....	44
18		Selection 77.....	43
19	Cross 100.....		43
20		Hickory King.....	41
21		Red Blaze.....	39
22		Ohio Leaming.....	39
23		Silvermine.....	38
24		Illinois Leaming.....	38
25		Reid Yellow Dent.....	38
26		Whitecap.....	36
27		Cross 100.....	36
28		Golden Eagle.....	32
29		Sturges Hybrid Flint.....	30

STOVER WEIGHTS OF PARENTS AND CROSSES COMPARED.

As no determinations were made of the water content of the stover, a comparison of weights of stover at harvest time does not represent food value and is of little importance except in indicating the earliness of maturity of the crosses and parent varieties. The stalks of the later maturing varieties contained considerable sap when weighed the latter part of October, while those of the earlier maturing varieties contained very little sap. In 4 cases out of the 14 the stover weight of the crosses is lighter than the average of the two parents. In 3 of these 4 cases the female parent matures fully 10 days earlier than Selection 119.

In general, the crosses seemed intermediate between the parents regarding height and time of maturing. It seems that the earlier maturing parents transmitted to their crosses their early-maturing character in sufficient degree to cause the stover to weigh less than the average for the two parents. Sturges Hybrid, the only flint variety in the test, is an exception in this respect. In no instance was the stover weight of a cross as light as that of the lighter producing parent.

The cross of Cross 120, which gave so remarkable an increase in grain production, also gave 14 per cent increased stover weight over

the heavier producing parent and 16 per cent increase over the average of its two parents. The Whitecap cross also gave 16 per cent increase over the average of its two parents and 12 per cent over the heavier producing parent, but in grain production it fell 6 per cent below the better of its two parents.

Of the 14 first-generation crosses of distinct varieties 10 produced fewer pounds of stover than the heavier yielding of the two parents.

CORN CROSSES AT CHICO, CAL., 1910.

CONDITIONS OF THE TEST.

The crosses made in 1909 in Maryland were also grown at Chico, Cal., in 1910, in comparison with their parent varieties. The plantings were so arranged that each row of the cross came between rows of its parent varieties.

The soil upon which these plantings were made was medium loam which had grown alfalfa for four years previous to 1910.

The land was broken to a depth of about 10 inches in December, 1909, with a second breaking in April, 1910, to a depth of 6 inches, and marked out in shallow furrows $3\frac{1}{2}$ feet apart. Both plowings were made in lands running north and south and the corn rows were marked out east and west, so that no rows would fall on dead or back furrows.

On April 14 three kernels were dropped by hand in each hill in the furrows and lightly covered with the foot. Hills were $3\frac{1}{2}$ feet apart in the row and 80 to each row. Four cultivations were given during the season.

On account of the surface soil being somewhat dry at planting time and some seed being taken by gophers, an uneven stand resulted.

The rainfall after planting amounted to less than one-half inch and no irrigation was given. Sufficient water was contained in the soil early in the season to give all varieties a good growth of stalk, the average height being about $8\frac{1}{2}$ feet. This moisture supply was not great enough, however, to produce a good crop of ears. Many of the ears were small and about 25 per cent of the stalks were barren.

The number of stalks per row, number of hills, average number of stalks per hill, pounds of ears per row, average number of pounds per stalk, percentage increase in yield per stalk of cross over the better parent, number of good and poor ears, and weight of stover are given in Table VI.

The order of plantings is preserved in the table, but for greater ease in comparing the cross with its parent varieties each row of Selection 119 is given twice.

The yield per stalk of the different varieties is represented graphically in diagram 1.

DIAGRAM 1.—*Variation in yield per stalk of crosses and parent varieties of corn at Chico, Cal., 1910.*¹

Field row No.	Variety and cross.	Pound.				
		0.0	0.1	0.2	0.3	0.4
1	Selection 119.....	_____				
2	Illinois Leaming×119.....	_____				
3	Illinois Leaming.....	_____				
4	Selection 78.....	_____				
5	Selection 78×119.....	_____				
6	Selection 119.....	_____				
7	Reid Yellow Dent×119.....	_____				
8	Reid Yellow Dent.....	_____				
9	Fraley Yellow Dent.....	_____				
10	Fraley Yellow Dent×119.....	_____				
11	Selection 119.....	_____				
12	Silvermine×119.....	_____				
13	Silvermine.....	_____				
14	Selection 137.....	_____				
15	Selection 137×119.....	_____				
16	Selection 119.....	_____				
17	Selection 138×119.....	_____				
18	Selection 138.....	_____				
19	Hickory King.....	_____				
20	Hickory King×119.....	_____				
21	Selection 119.....	_____				
22	Golden Eagle×119.....	_____				
23	Golden Eagle.....	_____				
24	Whitecap.....	_____				
25	Whitecap×119.....	_____				
26	Selection 119.....	_____				
27	Cross 100×119.....	_____				
28	Cross 100.....	_____				
29	Selection 159.....	_____				
30	Selection 159×119.....	_____				
31	Selection 119.....	_____				
32	Ohio Leaming×119.....	_____				
33	Ohio Leaming.....	_____				
34	Sturges Hybrid Flint.....	_____				
35	Sturges Hybrid Flint×119.....	_____				
36	Selection 119.....	_____				
37	Selection 77×119.....	_____				
38	Selection 77.....	_____				
39	Selection 119 (1908).....	_____				
40	Selection 119 (1908)×119.....	_____				
41	Selection 119.....	_____				
42	Cross 120×119.....	_____				
43	Cross 120.....	_____				
44	Red Blaze.....	_____				
45	Red Blaze×119.....	_____				
46	Selection 119.....	_____				

¹ The yield of first-generation crosses is indicated by the heavier lines.

TABLE VI.—Tests of production of parent varieties and first-generation crosses of corn at Chico, Cal., 1910.

Field row No.	Variety and cross.	Stalks.	Hills.	Stalks per hill.	Yield.							
					Weight of ears.			Number of ears.		Weight of stover.		
					In row.	Per stalk.	Increase per stalk over better parent.	Good.	Poor.	Per row.	Per stalk.	
					Lbs.	Lbs.	P. ct.			Lbs.	Lbs.	
1	Selection 119.....	169	72	2.4	41	0.242	.....	52	75	130	0.770	
2	Illinois Leaming×119.....	140	65	2.1	37	.264	.....	48	68	106	.757	
3	Illinois Leaming.....	111	50	2.2	28	.254	4	40	48	69	.622	
4	Selection 78.....	131	52	2.5	31	.247	.....	48	42	83	.633	
5	Selection 78×119.....	142	61	2.3	35	.248	0	52	57	106	.747	
6	Selection 119.....	155	71	2.2	35	.226	.....	40	68	137	.884	
6	Selection 119.....	155	71	2.2	35	.226	.....	40	68	137	.884	
7	Reid Yellow Dent×119.....	122	56	2.2	34	.278	—1	52	44	85	.697	
8	Reid Yellow Dent.....	146	68	2.1	41	.281	.....	57	51	97	.665	
9	Fraily Yellow Dent.....	142	67	2.1	27	.190	.....	38	58	118	.832	
10	Fraily Yellow Dent×119.....	149	70	2.3	32	.215	0	40	60	133	.894	
11	Selection 119.....	159	68	2.4	34	.214	.....	36	75	121	.761	
11	Selection 119.....	159	68	2.4	34	.214	.....	36	75	121	.761	
12	Selection 119.....	159	68	2.4	34	.214	.....	36	75	121	.761	
12	Silvermine×119.....	160	68	2.3	51	.318	—17	65	68	123	.769	
13	Silvermine.....	107	60	1.8	41	.383	.....	55	54	70	.654	
14	Selection 137.....	108	60	1.8	31	.287	.....	42	58	99	.916	
15	Selection 137×119.....	148	64	2.3	47	.331	15	60	60	134	.906	
16	Selection 119.....	147	63	2.3	39	.265	.....	57	68	117	.796	
16	Selection 119.....	147	63	2.3	39	.265	.....	57	68	117	.796	
17	Selection 138×119.....	141	67	2.1	50	.355	4	62	72	156	1.105	
18	Selection 138.....	146	69	2.1	50	.342	.....	68	70	135	.925	
19	Hickory King.....	122	59	2.1	27	.221	.....	56	62	106	.870	
20	Hickory King×119.....	129	60	2.1	39	.303	—15	72	52	122	.946	
21	Selection 119.....	163	70	2.3	58	.356	.....	74	80	132	.810	
21	Selection 119.....	163	70	2.3	58	.356	.....	74	80	132	.810	
22	Golden Eagle×119.....	144	66	2.2	64	.445	16	92	47	120	.834	
23	Golden Eagle.....	122	58	2.1	47	.385	.....	72	42	75	.615	
24	Whitecap.....	109	50	2.2	26	.238	.....	35	52	110	1.010	
25	Whitecap×119.....	116	59	2.0	37	.319	8	44	56	129	1.113	
26	Selection 119.....	126	53	2.4	37	.294	.....	37	69	110	.872	
26	Selection 119.....	126	53	2.4	37	.294	.....	37	69	110	.872	
27	Cross 100×119.....	123	61	2.0	40	.325	11	55	60	113	.918	
28	Cross 100.....	121	58	2.1	21	.173	.....	52	63	101	.834	
29	Selection 159.....	99	53	1.9	26	.263	.....	34	54	85	.859	
30	Selection 159×119.....	107	54	2.0	31	.290	—11	40	57	104	.972	
31	Selection 119.....	115	52	2.2	37½	.326	.....	46	57	111	.965	
31	Selection 119.....	115	52	2.2	37½	.326	.....	46	57	111	.965	
32	Ohio Leaming×119.....	114	53	2.1	37	.324	—15	50	62	92	.806	
33	Ohio Leaming.....	102	54	1.9	39	.382	.....	64	40	60	.587	
34	Sturges Hybrid Flint.....	79	49	1.6	19	.241	.....	40	40	67	.849	
35	Sturges Hybrid Flint×119.....	106	50	2.1	35	.330	—11	52	60	106	1.000	
36	Selection 119.....	80	41	2.0	29½	.369	.....	42	40	77	.961	
36	Selection 119.....	80	41	2.0	29½	.369	.....	42	40	77	.961	
37	Selection 77×119.....	95	44	2.2	30½	.369	0	36	52	90	.946	
38	Selection 77.....	71	35	2.0	27	.380	.....	44	32	70	.686	
39	Selection 119 (1908).....	95	45	2.1	23½	.248	.....	26	63	93	.930	
40	Selection 119×119.....	83	50	1.7	31	.373	20	32	63	94	1.130	
41	Selection 119.....	95	46	2.1	29½	.310	.....	36	52	93	.930	
41	Selection 119.....	95	46	2.1	29½	.310	.....	36	52	93	.930	
42	Cross 120×119.....	111	59	1.9	41	.373	12	45	68	125	1.125	
43	Cross 120.....	75	39	1.9	25	.334	.....	43	37	67	.893	
44	Red Blaze.....	67	37	1.8	22	.328	.....	38	38	54	.806	
45	Red Blaze×119.....	111	57	1.9	43½	.395	20	64	54	97	.875	
46	Selection 119.....	89	44	2.0	22	.247	.....	26	58	80	.900	

COMPARISON OF CROSSES WITH PARENT VARIETIES.

It has been claimed, though not universally accepted, that first-generation corn crosses are superior in producing power to the varieties crossed. The data herein submitted seem to bear out such a conclusion when the majority of cases and the average of all are considered.

Of the 18 crosses included in this test, only 2 do not exceed in yield the average of the two varieties crossed. The average yield per stalk of the 10 plantings of Selection 119 is 0.280 pound; for the 18 varieties used as female parents, 0.284 pound; and for the crosses, 0.320 pound; an increase of 0.038 pound per stalk in favor of the average of the crosses.

There is no special advantage in growing first-generation crosses unless such crosses can be depended upon to yield consistently and constantly more than either of the varieties used in making the cross. This gain must be sufficiently large to insure compensation for the rather careful work necessary in making the cross and in keeping pure two varieties of corn for this purpose.

Of the 18 crosses in this test, 9 exceed either parent in the yield per stalk, and 9 are equaled or exceeded by one or the other of the parents. The difference in the yields of the better parent and of the cross ranges in amount from 4 to 20 per cent in the 9 comparisons in which the crosses exceed, and from zero to 17 per cent in the 9 in which the better parent exceeds the cross.

Not only are there the same number of comparisons in which the cross exceeds and fails to exceed the better parent, but the average yield per stalk of the crosses and that of the better parents is the same, being 0.320 pound in each case.

These data do not show that first-generation crosses can, in the greater number of cases, be depended upon to produce more than the better of the two varieties crossed.

Two additional crosses were grown in the test at Chico. The male parent used was Selection 160, a large yellow flint. This corn has been grown in California for 12 years or more and at Chico for 5 years. It seems to be well acclimated and has proved to be the best yielder of a number of varieties grown at Chico in the last 3 years.

The two varieties used as female parents were Ohio Leaming and Silvermine. Next to Selection 160 these have been the highest yielding of the varieties tested at Chico.

The crosses were made by hand-pollinating ears of these two varieties with pollen from Selection 160 in the varietal test rows at Chico in 1909. Several ears in each variety were also pollinated with pollen from different stalks of the same variety. In this way seed of the cross and that of the female parent used in the experiment

in 1910 was grown under identical conditions in 1909. The Selection 160 seed was also taken from the 1909 crop and from detasseled stalks in a near-by, though sufficiently isolated, field.

These two crosses are compared with their parent varieties in Table VII.

TABLE VII.—*Relative productiveness of first-generation crosses and parent varieties of corn crosses made and tested at Chico, Cal.*

Row No.	Variety and cross.	Stalks.	Hills.	Stalks per hill.	Yield.				
					Weight of ears.			Number of ears.	
					In row.	Per stalk.	De-crease per stalk under better parent.	Good.	Poor.
					<i>Pounds.</i>	<i>Pounds.</i>	<i>P. ct.</i>		
47	Silvermine.....	149	65	2.3	54	0.362	.....	72	52
48	Silvermine×Selection 160....	139	61	2.1	53	.382	10	88	46
49	Selection 160.....	140	64	2.2	59.5	.425	.....	112	44
49	Selection 160.....	140	64	2.2	59.5	.425	.....	112	44
50	Ohio Leaming×Selection 160.	152	63	2.4	60.5	.398	9	111	61
51	Ohio Leaming.....	144	67	2.1	42	.282	.....	58	50

RELATION OF ADAPTATION AND YIELD OF PARENT VARIETIES TO THE BEHAVIOR OF THE CROSSES.

Since there is a wide range of variability in the behavior of crosses between different varieties, it is of importance to discover, if possible, whether these differences have any relation to the yielding power of the parent varieties.

In this test, as is usual in a series of varieties collected from different localities and subjected to adverse conditions, a wide difference exists in the response of the different varieties to these conditions. Since all of the varieties are well selected and improved for the localities from which they came, the yield of each may be taken as an indication of its adaptation to the conditions of the test.

The highest yielding crosses (× Selection 119), arranged according to productiveness, are: Golden Eagle, Red Blaze, Cross 120, Selection 77, and Selection 138. A comparison of the yields of the original varieties shows that the female parents of these crosses rank in productiveness as follows: Golden Eagle, first; Red Blaze, seventh; Cross 120, sixth; Selection 77, fourth; Selection 138, fifth. The fact that the female parents of these high-yielding crosses rank high in yield among the original varieties is an indication that the adaptation and productivity of the parent variety determine the adaptation and productivity of the cross to some extent; or, in general, the highest yielding crosses may be expected to result from crossing the

highest yielding varieties. This view is supported by the results of a test of the same varieties and crosses in Maryland and also by the results obtained from the two crosses with Selection 160.

While this influence apparently exists, it is not sufficiently constant to be relied upon, as is shown by comparing the crosses Silvermine $\times$ Selection 119 and Ohio Leaming $\times$ Selection 119. The female parents of these crosses rank second and third in yield among the original varieties; the crosses are surpassed in productiveness by the crosses Sturges Hybrid Flint $\times$ Selection 119 and Cross 100 $\times$ Selection 119, the female parents of which rank low in yield.

The four best producers of the original varieties are Golden Eagle, Silvermine, Ohio Leaming, and Selection 77. The crosses of these four varieties with Selection 119 are distributed in the following manner as regards the degree of benefit from crossing: One case in which the cross shows a decided increase over the better parent, one in which the cross is intermediate between the two parents, and two in which the cross about equals the poorer parent.

The five poorest producing varieties are Cross 100, Fraley Yellow Dent, Hickory King, Whitecap, and Sturges Hybrid Flint. The crosses of these five varieties with Selection 119 are distributed as follows as regards benefit from crossing: Three better than the better parent, and two intermediate between the two parents.

The crosses with Selection 119 that show the greatest gain in yield over the better of their two parents are those of Red Blaze, Golden Eagle, Selection 137, and Cross 120. If yields of the original varieties and of the crosses are both considered, the female parents of these high-yielding crosses may be classed as one good and three intermediate in respect to yield.

From the examples set forth in the preceding paragraphs it would seem that no constant relation exists between the productivity of varieties and the increase or decrease in yield of their crosses as compared with the parent varieties. The lack of constancy in this relation may be seen in the following crosses: Ohio Leaming $\times$ Selection 119 produces less than either parent, although both are high-yielding varieties that have been pure bred for many years; the cross of Red Blaze (a high-yielding and well-selected variety) $\times$ Selection 119 gives an increase in yield of 20 per cent over the better parent; the cross of Cross 100, the lowest yielding variety in the test, with Selection 119 gives an increase in yield of 11 per cent over the better parent and practically equals in yield that of Ohio Leaming $\times$ Selection 119 (ranking eighth in yield among the crosses); while Fraley Yellow Dent, the next lowest yielding variety, crossed with Selection 119 is the lowest yielding cross in the test and is exceeded by all the varieties except Cross 100 and Fraley Yellow Dent.

These results show that some varieties combine or "nick" well, when crossed, forming crosses that are superior in yielding power to either parent, while other varieties do not combine well and the crosses are either less productive than the better parent or inferior to both parents. The factors that determine what the productiveness of the cross will be are not known, and apparently no external characters are discernible by which we can judge of their presence or absence. It is important, therefore, that crosses of varieties should be tried experimentally to ascertain their productiveness before growing them commercially or before making a general agricultural application of this method of corn breeding.

It is worthy of note that the crosses which produced best under the somewhat adverse conditions at Chico are not from the same combinations as those which produced best under conditions of normal rainfall in Maryland.

Table VII shows a comparison between an acclimated, well-adapted variety, the crosses of this with two varieties of later introduction, and these two varieties themselves.

In each of these comparisons the cross is intermediate in yield per stalk between the two varieties crossed. In other words, nothing was gained in yield by crossing an adapted, well-acclimated variety with a variety of later introduction, even though this variety is also a good yielder.

TESTS IN TEXAS.

WORK OF 1909.

Seed of a number of pure-bred varieties of corn was obtained early in 1909 for use in crossbreeding experiments in Texas. A list of these varieties and a brief description is given in Table VIII. The varieties were planted at Waco, Tex., early in March, 1909, one row of each of the other varieties alternating with two rows of Chisholm (the variety chosen to be the male parent). Tassels were removed from the stalks of all varieties except the Chisholm before any pollen had been shed. The crosses made in this manner, each having the same male parent but a different female parent, were planted in 1910 at Sherman, at Waco, and at Corsicana.

TABLE VIII.—Varieties of corn and first-generation crosses used in Texas tests.

Variety.	Parentage.	Region of growth.	Days to mature.	Color and class.	Height of stalk (feet). ¹	
					Pure variety.	First-generation cross.
Huffman.....	Pure selection since 1851.....	Central Tennessee for 60 years.....	140	White dent.....	8-8½	7 7½
Selection 136.....	Laguna, from Mexico.....	Central Texas for 7 years.....	125-130	do.....	7½-8	6-8
Selection 137.....	Boone County White.....	Central Texas for 5 years.....	110-115	do.....	6½	6½
Singleton.....	A selection from a strawberry type of corn.....	Northern Texas for 30 years.....	120	Striped dent.....	7½-8	7-7½
McCullough.....	A cross of two yellow varieties made in 1901.....	Northern Texas a number of years.....	120	Yellow dent.....	7	7
Gorham Yellow.....	Believed to have originated from a Kansas variety.....	Central Texas for 5 years or longer.....	120	do.....	6	6-6½
Dan Patch.....	Native strain in South Texas, probably mixed with Mexican varieties.....	South-central Texas 25 years or longer.....	110	White dent.....	6½	6-7
Blow.....	A local native variety in Anderson County.....	Eastern Texas for 24 years.....	120	do.....	6½-7	6½-7
Lily of the Valley.....	Chisholm.....	Northern Texas a number of years.....	120	do.....	6½-7	6½-7
Schleberle.....	A cross between a white dent variety and Gourd Seed.....	Southern Texas for 20 years.....	125-130	do.....	7½-8	6½-7
Munson.....	Taken from Georgia to Texas previous to 1905.....	Central and northern Texas 6 years or longer.....	125-130	do.....	6-7	7
Gourd Seed.....	Native unselected variety.....	South-central Texas about 30 years.....	120	do.....	7-7½	6½-7
Ferguson Yellow.....	Northern Texas variety of yellow corn.....	Northern Texas.....	120	Yellow dent.....	7	7
Mosby Prolific.....	South American and Mississippi varieties crossed in 1876 in Mississippi.....	Southern and northern Texas 5 years.....	120	White dent.....	6-7	6-7
Surropper.....	Native strain in southern Texas grown under various names; probably at some time mixed with Mexican varieties.....	South-central Texas 25 years or longer; northern Texas 4 years.....	110	do.....	6-7	6½
Chisholm.....	A red-cob white dent—well known in northern Texas.....	Northern Texas about 30 years.....	120	do.....	6	.....

¹ As grown at Waco.

WORK OF 1910.

TEST AT SHERMAN, TEX.

The test at Sherman was located upon fertile black upland of uniform appearance. All the land used had been cropped the same the previous year, had been broken deep, and was in good condition when the corn was planted.

The planting was made in hills $3\frac{1}{2}$ feet apart each way; the crop was cultivated frequently, and the ground kept free of grass and weeds. The season at Sherman was extremely dry and the yields were very light.

The order in which the varieties and crosses were planted and their field-row numbers are shown in Table IX. Because of lack of uniformity in number of stalks per row of the different varieties, the comparisons have been made on the basis of production per stalk rather than on row yields. This method is followed in all cases.

The comparison is made between the yield of the cross and the higher yielding of the two parents. For practical purposes the cross can not be regarded as an improvement upon existing conditions or as worthy of propagation unless it is superior to the better parent. Where the comparison is between the cross and male parent the average of the two rows of the male parent nearest the cross has been used. This was also done in the test at Waco and Corsicana. The seed of the female parents used in the experiment is in every case taken from the 1908 crop, that is, from the same lot of seed that was used for the beginning of the experiment in 1909. The seed of the crosses is from the 1909 crop. The seed of Chisholm (the male parent) is in part from the 1908 crop, but mostly from the 1909 crop, entirely so at Sherman and Corsicana, and also in the greater part of the Waco test.

When the crop was harvested, determinations showed the percentage of moisture to be approximately the same for the different varieties. Taking into consideration the unavoidable percentage of error, it was believed that nothing would be gained by calculating the yields to a water-free basis. In computing the production per stalk only the main stalks were considered, as the suckers were not productive at any of the three places.

TABLE IX.—Comparative productiveness of parent varieties of corn and first-generation crosses at Sherman, Tex., in 1910.

[Area of each row one-seventieth of an acre.]

Row No.	Variety and cross.	Main stalks per row.	Suck-ers per row.	Yield of ears (husked).			Number of ears.	
				Per row.	Per stalk.	In-crease over better parent.	Good.	Poor.
				Pounds.	Pounds.	Per ct.		
2	Chisholm.....	76	3	91	0.125		3	37
3	Huffman × Chisholm.....	101	17	9	.069	-28	2	40
4	Huffman.....	105	39	3	.029		0	16
5	Chisholm.....	81	4	70	.123		4	39
6	Schieberle × Chisholm.....	107	7	91	.069	-32	0	41
7	Schieberle.....	101	5	111	.114		0	49
8	Chisholm.....	84	6	111	.140		5	44
9	Munson × Chisholm.....	100	19	12	.120	-21	3	49
10	Munson.....	97	21	9	.093		0	43
11	Chisholm.....	79	1	13	.165		6	45
12	Gourd Seed × Chisholm.....	96	13	17	.177	16	5	68
13	Gourd Seed.....	98	4	14	.143		0	57
14	Chisholm.....	89	0	121	.140		6	39
15	Lily of the Valley × Chisholm.....	100	7	181	.182	5	6	57
16	Lily of the Valley.....	95	6	161	.174		8	56
17	Chisholm.....	78	2	121	.160		4	43
18	Blow × Chisholm.....	101	27	141	.144	-17	2	61
19	Blow.....	101	11	9	.089		0	49
20	Chisholm.....	84	3	151	.184		2	57
21	Selection 136 × Chisholm.....	100	9	191	.195	23	6	66
22	Selection 136.....	101	13	16	.158		3	72
23	Chisholm.....	81	8	101	.130		0	48
24	Surcropper × Chisholm.....	106	3	231	.219	-8	5	79
25	Surcropper.....	100	6	231	.238		8	80
26	Chisholm.....	94	8	12	.128		1	47
27	Dan Patch × Chisholm.....	93	8	23	.247	13	3	83
28	Dan Patch.....	94	5	201	.218		5	74
29	Chisholm.....	89	7	12	.135		4	45
30	Selection 137 × Chisholm.....	102	22	171	.172	-6	4	71
31	Selection 137.....	92	6	161	.182		4	62
32	Chisholm.....	81	8	14	.173		2	51
35	Mosby Prolific × Chisholm.....	103	15	12	.117	-33	2	58
36	Mosby Prolific.....	92	35	8	.087		0	61
37	Chisholm.....	101	10	18	.178		6	62
38	Gorham Yellow × Chisholm.....	103	17	141	.141	-8	5	53
39	Gorham Yellow.....	96	13	111	.120		1	56
40	Chisholm.....	101	14	13	.129		4	53
41	Ferguson Yellow × Chisholm.....	101	10	121	.124	-18	1	69
42	Ferguson Yellow.....	98	13	131	.138		3	65
43	Chisholm.....	95	6	151	.163		3	68
44	McCullough × Chisholm.....	98	3	15	.153	-2	4	56
45	McCullough.....	100	10	13	.130		2	63
46	Chisholm.....	100	10	15	.150		0	70
47	Singleton × Chisholm.....	96	12	111	.122	-22	0	59
48	Singleton.....	98	6	11	.112		0	52

In 11 out of 15 comparisons the cross ranges from 2 to 33 per cent lower in yield than the better parent; in the remaining four comparisons the cross outyields the better parent by 5 to 23 per cent.

TEST AT WACO, TEX.

At Waco the test was located on deep Brazos Valley sand and the corn was drilled in rows $3\frac{1}{2}$ feet apart. A late frost killed some of the plants and so interfered to some extent with the uniformity of the stand. For this reason the comparisons of yields, as in the test at Sherman, have been made on the basis of production per stalk. The stands of three of the crosses were so uneven and irregular

that the comparisons could not be regarded as of value, and accordingly have not been considered in the results. The order of planting the varieties and crosses and their field-row numbers are shown in Table X.

TABLE X.—Comparative productiveness of parent varieties of corn and first-generation crosses at Waco, Tex., in 1910.

[Area of each row one-seventieth of an acre.]

Row No.	Variety and cross.	Main stalks per row.	Suckers per row.	Yield of ears (husked).			Number of ears.	
				Per row.	Per stalk.	Increase over better parent.	Good.	Poor.
				Pounds.	Pounds.	Per ct.		
4	Chisholm	46	0	19	0.413		19	21
5	Schieberle×Chisholm	54	0	30½	.565	7	31	24
6	Schieberle	38	0	20	.526		20	14
7	Chisholm	37	0	14	.378		11	26
8	Singleton×Chisholm	53	0	26½	.500	3	34	16
9	Singleton	37	0	18	.486		14	22
10	Chisholm	53	0	20	.377		20	27
11	McCullough×Chisholm	49	0	24	.490	29	30	20
12	McCullough	48	0	15	.312		13	30
13	Chisholm	54	0	20½	.380		19	30
14	Ferguson Yellow×Chisholm	60	0	32	.533	21	38	23
15	Ferguson Yellow	50	0	22	.440		15	34
16	Chisholm	65	0	29	.446		23	38
17	Gorham Yellow×Chisholm	51	0	26	.510	23	21	32
18	Gorham Yellow	34	0	12	.353		10	19
26	Selection 137	40	0	12	.300		4	30
27	Selection 137×Chisholm	55	0	20	.364	-18	21	32
28	Chisholm	55	0	24	.436		30	20
29	Selection 136	65	0	34	.523		38	30
30	Selection 136×Chisholm	75	0	43	.573	10	45	30
31	Chisholm	38	0	17	.447		12	27
32	Surcropper	51	0	21	.412		20	33
33	Surcropper×Chisholm	46	0	20	.435	3	23	23
34	Chisholm	35	0	14	.400		14	18
38	Blow	51	0	19	.373		15	34
39	Blow×Chisholm	63	0	28½	.452	4	25	41
40	Chisholm	48	0	22	.458		22	26
41	Gourd Seed	66	2	38½	.583		40	25
42	Gourd Seed×Chisholm	68	0	42½	.625	7	56	15
43	Chisholm	35	0	14	.400		10	23
44	Munson	45	0	25	.556		26	21
45	Munson×Chisholm	52	0	30	.577	4	30	25
46	Chisholm	49	0	23	.469		22	24
47	Mosby Prolific	44	3	16	.364		24	24
48	Mosby Prolific×Chisholm	53	5	23	.434	-9	42	13
49	Chisholm	41	0	20	.488		16	32

In 10 of the 12 comparisons the cross outyields the better parent, the increase ranging from 3 to 29 per cent; in the remaining 2 comparisons the cross yields 18 and 9 per cent less than the better parent.

TEST AT CORSICANA, TEX.

At Corsicana the test was located on sandy loam of medium fertility. The corn was planted in hills 3½ feet apart each way, cultivated well, and kept free of grass and weeds. The planting was made in a different manner from that at Sherman and at Waco, a smaller number of rows of Chisholm were planted and these were

arranged so that two of the crosses were planted adjacent to the same row of Chisholm. One of the crosses (Schieberle×Chisholm) was cut by mistake when green and fed to stock. The order of planting the varieties and crosses, and their field-row numbers, together with the results of the test, are shown in Table XI.

TABLE XI.—*Comparative productiveness of parent varieties of corn and first-generation crosses at Corsicana, Tex., in 1910.*

[Area of each row one eighty-sixth of an acre.]

Row No.	Variety and cross.	Main stalks per row.	Suckers per row.	Yield of ears (husked).			Number of ears.	
				Per row.	Per stalk.	Increase over better parent.	Good.	Poor.
				<i>Pounds.</i>	<i>Pounds.</i>	<i>Per ct.</i>		
7	Singleton.....	74	6	23½	0.317	.....	24	32
8	Singleton×Chisholm.....	76	2	24½	.322	2	27	37
9	Chisholm.....	70	4	20½	.263	.....	28	28
10	McCullough×Chisholm.....	78	0	27	.346	11	32	30
11	McCullough.....	75	2	23½	.313	.....	30	33
12	Ferguson Yellow.....	83	0	34½	.416	.....	40	35
13	Ferguson Yellow×Chisholm.....	83	0	32	.386	— 7	40	30
14	Chisholm.....	84	4	26½	.315	.....	30	33
15	Gorham Yellow×Chisholm.....	77	0	30½	.396	21	40	31
16	Gorham Yellow.....	69	0	22	.319	.....	20	40
17	Selection 136.....	83	0	35	.422	.....	48	28
18	Selection 136×Chisholm.....	80	5	35	.437	4	40	36
19	Chisholm.....	65	0	22	.338	.....	23	30
20	Surcropper×Chisholm.....	87	3	35½	.408	— 2	40	40
21	Surcropper.....	79	0	33	.418	.....	36	43
22	Dan Patch.....	78	2	34	.436	.....	44	28
23	Dan Patch×Chisholm.....	84	12	39	.464	6	38	47
24	Chisholm.....	85	3	30	.353	.....	35	38
25	Blow×Chisholm.....	95	5	34½	.383	— 2	36	48
26	Blow.....	77	3	25	.325	.....	26	40
27	Lily of the Valley.....	75	2	30½	.407	.....	26	34
28	Lily of the Valley×Chisholm.....	74	0	39½	.534	31	51	26
29	Chisholm.....	67	5	26	.388	.....	28	30
30	Gourd Seed×Chisholm.....	78	7	34½	.442	7	40	36
31	Gourd Seed.....	76	0	31½	.414	.....	28	41
32	Munson.....	77	3	25½	.331	.....	28	40
33	Munson×Chisholm.....	84	4	30½	.363	— 2	32	43
34	Chisholm.....	76	0	27	.355	.....	35	30
35	Mosby Prolific×Chisholm.....	85	8	34	.400	6	52	27
36	Mosby Prolific.....	81	11	27½	.340	.....	52	30
37	Selection 137.....	68	0	25	.368	.....	30	28
38	Selection 137×Chisholm.....	77	0	28½	.370	— 2	32	36
39	Chisholm.....	75	3	30	.400	.....	28	34
46	Chisholm.....	77	4	23	.299	.....	24	44
47	Huffman×Chisholm.....	79	8	21½	.272	—14	24	44
48	Huffman.....	77	0	18	.234	.....	16	36

The cross outyields the better parent in 8 comparisons out of the 14, the increase ranging from 2 to 31 per cent; in the remaining 6 comparisons the better parent outyields the cross by 1 to 9 per cent.

THE THREE TEXAS TESTS CONSIDERED COLLECTIVELY.

In considering the three tests collectively the relatively higher production of the Chisholm variety (male parent) at Sherman than at Waco and Corsicana is apparent. At Sherman it outyields the cross in 9 and the female parent in 10 out of 15 comparisons. At Waco it

outyields the cross in but 2 and the female in 5 out of 12 comparisons. At Corsicana it outyields the cross in 4 and the female parent in 5 out of 14 comparisons. The results at Waco and Corsicana are practically a reversal of the results with Chisholm at Sherman.

The 5 varieties that outyield Chisholm at Sherman are Surcropper, Dan Patch, Selection 137, Lily of the Valley, and Ferguson Yellow Dent. The first three varieties are earlier maturing than Chisholm; their increase in yield over Chisholm is considerably greater than the increase of Lily of the Valley and Ferguson Yellow Dent over Chisholm. This would indicate that the superiority of the first three varieties has been due chiefly to their earliness, which made them particularly suited to the drought conditions that prevailed at Sherman in 1910. From previous experience there is reason to believe that during a normal season Chisholm would be considerably more productive than any of these three varieties. The fourth variety (Lily of the Valley) is another strain of the same variety as Chisholm, its increase over Chisholm is not especially significant, although perhaps indicating a slight superiority, as Lily of the Valley outyielded Chisholm also at Corsicana. The increase of Ferguson Yellow over Chisholm is slight, and can not be regarded as indicating very much, if any, superiority. Taking into consideration the average behavior of Chisholm in all the rows in which it was planted, it perhaps should be considered as superior to any of the varieties for practical growing at Sherman.

The relatively greater productiveness of Chisholm in the Sherman test than at Waco and at Corsicana is due probably to the fact that Chisholm is a northern Texas variety, and the particular strain used in these experiments has been grown for many years on fertile black lands near Sherman. This doubtless has caused the variety to be better adapted to its environment at Sherman than it was at Waco or at Corsicana. Its yields also indicate that it was better adapted to the Sherman environment than were the other varieties in the test. The higher yields of the three early maturing varieties does not seem to have been due to better adaptation, but rather that the abnormal conditions of the season were less disastrous to them than to the later maturing varieties. The increase of Ferguson Yellow Dent, itself a northern Texas variety, is so slight that no generalization is warranted that it is better adapted to the Sherman environment than is Chisholm.

Of the varieties used as female parents none has been bred for any length of time for the conditions encountered at any of the three places. At Sherman the conditions were very adverse and the yields very poor. At Waco, in the Brazos Valley, conditions were more favorable. The soil retained the moisture better than the soil at

Sherman and more moisture was available for the growing crop; higher yields were made, but Chisholm seems to be less suited to the conditions than most of the other varieties. The female parents made an increase of 223 per cent in average production per stalk over their average production per stalk at Sherman; the same increase for Chisholm is 186 per cent. The results at Corsicana were similar and as pronounced, although actual yields were lower than at Waco.

As has been stated, Chisholm at Sherman, to which conditions it has been thoroughly adapted, outyielded the cross in 9 out of 15 comparisons. At Waco, planted in the deep, sandy soil of the Brazos Valley, conditions to which the variety is apparently not adapted, it is outyielded by the cross in 10 out of 12 comparisons. At Corsicana, under conditions to which it was apparently also not adapted, it is outyielded by the cross in 10 out of 14 comparisons.

In the Waco and Corsicana tests the crosses in the majority of comparisons outyielded the parent varieties. None of the varieties used in the tests had been bred for any length of time for the environmental conditions encountered at either place. At Sherman the Chisholm variety, which has been grown for many years in that locality, outyielded the crosses in most of the comparisons. This would indicate that in general a variety well adapted to its environment is not improved nor its productiveness increased by crossing with other varieties possibly less adapted to the environment. What results would be obtained by crossing varieties that have been bred in the same locality and under the same conditions for a long period will have to be determined by further experimental work. Although in this connection attention should be called to the fact that crosses with such varieties as McCullough, Ferguson Yellow, and Singleton (all established northern Texas varieties that have been bred under very similar conditions to Chisholm) are less productive than Chisholm.

THE PRODUCTIVITY OF THE PARENT VARIETIES AND ITS INFLUENCE UPON THE
PRODUCTIVITY OF THE CROSSES.

In Table XII an attempt has been made to trace as far as the fifth or sixth rank in yield the factors showing to what extent the highest yielding crosses are progeny of the highest yielding varieties; also to what extent the highest yielding crosses may be identical with the crosses showing highest percentage of gain over better parent.

Table XIII is a similar enumeration of the poorest yielding varieties, poorest yielding crosses, and crosses showing the greatest percentage of decrease as compared with the better parent.

In the Sherman test the six highest yielding crosses are identical with the crosses of the six highest yielding female parents, but they

do not rank in exactly the same order as the parent varieties. The crosses showing the greatest percentage of increase over the better parent are identical with four of the highest yielding crosses. In the list of poorest yielding crosses four are identical with four of the crosses of the poorest yielding female parents with Chisholm. The crosses showing the greatest percentage of decrease as compared with the better parent are the same as the poorest yielding crosses and, with one exception, are progeny of the poorest yielding female parents.

In the Waco test four of the highest yielding crosses are identical with four of the crosses of the highest yielding female parents. Of the crosses listed as showing the greatest percentage of increase over the better parent four are identical with four of the highest yielding crosses, three are progeny of three of the highest yielding female parents, and two are progeny of two of the poorest yielding female parents. Four of the poorest yielding crosses are progeny of four of the poorest yielding female parents. The two crosses that are less productive than the better parent are both progeny of low-yielding female parents.

TABLE XII.—*Relation of the highest yielding crosses and crosses showing highest percentage of increase to the highest yielding parents, in Texas, 1910.*

Locality.	Female parent (best yielding, in order of productiveness).		Cross.		High-yielding cross.		Cross showing high percentage of increase over better parent.	
	Variety.	Yield per stalk.	Variety (× Chisholm) and rank.	Yield per stalk.	Variety (× Chisholm) and rank.	Yield per stalk.	Variety (× Chisholm).	Gain.
Sherman.	(Surrigger	Pounds.	Surrigger, 2	Pounds.	Dan Patch, 1	Pounds.	Selection 136	Per cent.
	Dan Patch 1	0.238	Dan Patch, 1	0.219	Surrigger, 2	0.247	Gourd Seed	23
	Selection 137	.218	Selection 137, 6	.247	Selection 136, 3	.219	Dan Patch	16
	Lily of the Valley ¹	.182	Lily of the Valley, 4	.172	Lily of the Valley, 4	.195	Lily of the Valley	13
	Selection 136	.174	Selection 136, 3	.182	Gourd Seed, 5	.182		5
	(Gourd Seed	.158	Gourd Seed, 5	.195	Selection 137, 6	.177		
Waco.	(Gourd Seed	.143		.177	Gourd Seed, 1	.625	McCullough	29
	Munson	.583	Gourd Seed, 1	.625	Munson, 2	.577	Gorham Yellow	23
	Schieberle ¹	.556	Munson, 2	.577	Selection 136, 3	.573	Ferguson Yellow	21
	Selection 136	.526	Schieberle, 4	.565	Schieberle, 4	.573	Selection 136	10
	Singleton	.523	Selection 136, 3	.573	Ferguson Yellow, 5	.533	Gourd Seed	7
		.496	Singleton, 7	.500			Schieberle	7
Corsicana.	(Dan Patch	.436	Dan Patch, 2	.464	Lily of the Valley, 1	.534	Lily of the Valley	31
	Selection 136	.422	Selection 136, 4	.437	Dan Patch, 2	.464	Gorham Yellow	24
	Surrigger	.418	Surrigger, 5	.408	Gourd Seed, 3	.442	McCullough	11
	Ferguson Yellow	.416	Ferguson Yellow, 8	.386	Selection 136, 4	.437	Gourd Seed	7
	Gourd Seed	.414	Gourd Seed, 3	.442	Surrigger, 5	.408	Mosby Profile	6
					Dan Patch		Dan Patch	6

¹ Not in the test at Waco.¹ Not in the test at Corsicana.

TABLE XIII.—*Relation of the lowest yielding crosses and crosses showing greatest percentage of decrease to the lowest yielding parents in Texas, 1910.*

Locality.	Female parent (poorest yielding in inverse order of productiveness).		Cross.		Poor-yielding cross.		Cross showing high percentage of decrease from better parent.	
	Variety.	Yield per stalk.	Variety (× Chisholm) and rank.	Yield per stalk.	Variety (× Chisholm) and rank.	Yield per stalk.	Variety (× Chisholm).	Decrease.
Sherman.	(Huffman 1.	Pounds.	Huffman, 14.	Pounds.	Huffman, 14.	Pounds.	Mosby Prolific.	Per cent.
	Mosby Prolific.	.029	Mosby Prolific, 13.	.089	Schieberle, 14.	.089	Schieberle.	33
	Blow.	.087	Blow, 8.	.117	Mosby Prolific, 13.	.089	Huffman.	28
	Munson.	.089	Munson, 12.	.144	Munson, 12.	.117	Singleton.	22
	(Singleton.	.093	Singleton, 11.	.120	Singleton, 11.	.120	Munson.	21
Waco.	(Selection 137.	.112	Selection 137, 12.	.122	Selection 137, 12.	.122	Selection 137.	18
	McCullough.	.300	McCullough, 8.	.364	Mosby Prolific, 11.	.364	Mosby Prolific.	9
	Gorham Yellow.	.312	Gorham Yellow, 6.	.400	Surcropper, 10.	.435		
	Mosby Prolific.	.353	Mosby Prolific, 11.	.510	Blow, 9.	.452		
	(Blow.	.373	Blow, 9.	.454	McCullough, 8.	.490		
Corseana.	(Huffman.	.234	Huffman, 13.	.272	Huffman, 13.	.272	Huffman.	9
	McCullough.	.313	McCullough, 11.	.346	Singleton, 12.	.322	Ferguson Yellow.	7
	Singleton.	.317	Singleton, 12.	.322	McCullough, 11.	.346	Selection 137.	2
	Gorham Yellow.	.319	Gorham Yellow, 7.	.396	Blow, 10.	.363	Munson.	2
	(Blow.	.325	Blow, 10.	.363	Munson, 10.	.363	Surcropper.	2

1 Not in test at Waco.

In the Corsicana test four of the highest yielding crosses are progeny of four of the highest yielding female parents. Among the crosses showing the greatest percentage increase over the better parent three are identical with three of the highest yielding crosses, two are progeny of the high-yielding female parents, and two are progeny of the poor-yielding female parents. Of the poorest yielding crosses, four are progeny of four of the poorest yielding female parents. Out of the crosses showing the greatest percentage of decrease from the better parent, one is the progeny of the poorest yielding female parent, and two are the progeny of two of the highest yielding female parents. Two are identical with two of the poorest yielding crosses.

It is evident in these tests that in general the most productive crosses have come from the most productive female parents; that the crosses showing the greatest percentage of increase over the better parents are in most instances identical with the highest yielding crosses. Likewise, in most cases, the poorest yielding crosses are from the poorest yielding female parents, as are also most of the crosses that show the greatest percentage of decrease in yield. There is no instance in which one of the highest yielding crosses springs from one of the poorest yielding female parents.

There are, however, both in the test at Waco and at Corsicana, two crosses (Gorham Yellow $\times$ Chisholm and McCullough $\times$ Chisholm) which stand high in the list of crosses showing greatest percentage increase over the better parent; they rank among the crosses in actual production per stalk sixth and eighth, respectively, at Waco, while at Corsicana the rank is seventh and eleventh. The female parents of these crosses are among the poorest yielding varieties at both places. These two comparisons are the most striking among the crosses in regard to increase over the parent varieties, but their actual yield is less than the best producing original varieties in the test, and there would be no incentive to grow them commercially.

These results would indicate the most promising method of securing increased yields to be by crossing the highest yielding varieties, but such a method would necessitate the previous testing of the varieties to ascertain the highest yielding, and the crosses could not then with certainty be depended upon to give increased yields, as is seen in the case of the cross Surcropper $\times$ Chisholm, which is less productive than Surcropper at both Sherman and Corsicana and but little more productive at Waco. Selection 137 $\times$ Chisholm is less productive than Selection 137 (the better parent) at Sherman, and less than Chisholm (the better parent) at Waco and at Corsicana. The crosses Gourd Seed $\times$ Chisholm and Selection 136 $\times$ Chisholm were

among the highest yielding in the three tests, the Dan Patch $\times$ Chisholm was not in the test at Waco, but at Sherman and at Corsicana it ranks among the highest yielders. These crosses also ranked well as regards percentage of increased yield over better parent.

Apparently, then, there are some varieties that combine well and their crosses will give decidedly increased yields; while the crosses of other varieties either show no improvement in yield, or an actual decrease. As no method is known of selecting the varieties the crosses of which can be depended upon to give increased yields, the importance of testing experimentally all crosses before growing them commercially may be readily appreciated by the farmer or corn grower who has in mind the betterment of his general crop by such methods of breeding.

TESTS AT STATESBORO, GA.

VARIETIES USED IN THE EXPERIMENTS.

ALDRICH PERFECTION.

Aldrich Perfection was obtained from a field near Barnwell, S. C. This variety is not very uniform in type, but has a large, deep, characteristic kernel. The kernel is very irregular in shape and gives the ear a very rough appearance. The variety is grown near Barnwell on very sandy land. As grown at Statesboro, it seemed poorly adapted the first year and the market quality was poor. During the second year it seemed better adapted and the market quality was fair.

COCKE PROLIFIC.

Cocke Prolific for this work was obtained from the North Carolina experiment station. The type showed much variation, but the variety has a characteristic appearance. As grown at Statesboro, the ears were fairly sound, but were seriously damaged by weevils. The adaptability was about the same both years.

MARLBORO PROLIFIC.

Marlboro Prolific was selected from a farm near Cheraw, S. C., where it has been grown for many years. The type of ear is not very uniform, but it has a characteristic appearance. The native soil of this variety is sandy, with sandy clay subsoil. As grown at Statesboro, Marlboro Prolific seemed to produce fairly well both years. The grain was seriously damaged by weevils, otherwise it was in good condition.

MOSBY PROLIFIC.

As grown at Montgomery, Ala., Mosby Prolific shows close selection and distinct type. The land upon which the corn was grown is low and flat. The soil is dark and is classed as limestone. As grown at Statesboro, the ears were fairly sound and seemed fairly well adapted during both seasons. It was seriously injured by weevils before harvesting.

NATIVE OF STATESBORO.

The variation in color indicates that the Native of Statesboro variety of corn is badly mixed, but the comparatively straight rows of well-formed, deep kernels and the shape of the ear show that it has had selection along certain lines. It has been grown on a farm near the one on which this test was made for 18 or 20 years, without the introduction of other seed, so far as is known. As grown in the test, the ears were fairly sound during both seasons. Weevils were found within practically all of the shucks, but only a small amount of damage had been done by the time the corn was harvested the first year and none the second year.

RODGERS WHITE DENT.

Rodgers White Dent was selected from a field near Darlington, S. C. The type of the ears and uniformity of the corn is probably more perfect than any other in the test. It has been the selection of one man for years. The land on which the corn has been grown is sandy, with sandy clay subsoil. As grown at Statesboro, the market quality was very good and during both seasons it seemed fairly well adapted.

SANDERS PROLIFIC.

As grown and developed at Danielsville, Ga., Sanders Prolific shows considerable selection and has a characteristic type. The seed used in these experiments was field selected. The field is upland and consists of a very poor red clay. Suitable seed could be found only where sediment had accumulated above the terraces. As grown at Statesboro, Ga., the ears tended to be chaffy and were badly damaged by weevils before harvesting. It was poorly adapted to Statesboro conditions in 1909, but one of the best, except for weevils, in 1910.

STATION YELLOW.

The Station Yellow variety of corn was obtained from the Alabama experiment station, and was especially recommended for resisting weevils. No selection was claimed for this corn, but it is known that it is a native of long standing at Auburn, Ala. It is

flinty and has a fairly uniform golden color. It has been grown largely upon poor upland clay. As grown at Statesboro, its market quality was fully the equal of any grown in the experiment. Weevils were found in practically all of the shucks, but little damage had been done at time of harvesting.

TINDAL.

The Tindal corn is a mixture of Marlboro Prolific with a native corn near Manning, S. C., where the variety is being grown. This seed was selected from the grower's field three or four years after the mixture had first been made. The type is mostly that of Marlboro Prolific, though there is considerable variation. In the Orange Judd Farmer's national corn test in 1906 this corn took first prize, with 182 bushels per acre. The soil on which this corn was grown is sandy, with sandy clay subsoil near surface. As grown at Statesboro, it performed much the same as Marlboro Prolific.

WHELCHER.

The Whelchel variety of corn was bred and developed at Gainesville, Ga., and is the result of crossing at least three varieties, one of which was Boone County White. The original ears used in this test were unusually large. The bushel from which the 10 ears were taken contained only 64 ears. Much variation is still seen in the type. The corn was developed on rich red-clay land. This variety proved poorly adapted to Statesboro conditions. Many ears developed poorly and many of those that did develop rotted in the husk. The market quality was unusually bad, and it was extremely difficult to obtain sufficiently strong germinating seed for the second year's work. The apparently high yield in 1910 was due at least to some extent to the moisture contained in the ears at harvest time. The quality of the corn was very poor.

WILLIAMSON.

The Williamson corn has been grown and selected near Darlington, S. C., for a good many years, and the type of ear, the kernels, and their rows are unusually uniform. The color, however, is not fixed and varies from nearly white to nearly yellow. In general the kernels are white or cream capped, shading into a yellow toward the cob. The cobs are mostly red, but there are some white ones. The variety has been developed on sandy soil with a sandy, clay subsoil, which at present is quite fertile. As grown at Statesboro the ears showed a slight tendency to spoil in the field, but its adaptation seemed to be nearly as good as the native seed, and it had not been greatly damaged by weevils when harvested.

WORK OF 1909.

Eleven varieties of corn represented by 10 ears of each were used.

The seed of the ears was not mixed, but planted in adjacent rows. The corn was dropped in hills, and two stalks, from 6 to 8 inches apart, were left in a hill.

Each hill represented two ears. In all 10 rows representing a variety the first plant in each hill was from the same ear. These plants served both as a standard of comparison and as a sire to the variety in that set of 10. The second plant in all hills of any one row represented one ear of a female parent and was detasseled.

Duplicate plantings were made from each of the ears. In one instance the standard or sire ears were of the Marlboro Prolific variety, and in the other instance the standard or sire ears were of the Rodgers White Dent variety.

The standard or sire ears used were also grouped and detasseled the same as the ears of the other varieties, so that a study of both the male and the female was afforded. Furthermore, by thus comparing the standards of all the varieties in the test the several varieties themselves could be compared.

The arrangement of the varieties with their pollen-bearing standards is given in Table XIV. The two fields in which the crossing was accomplished were well isolated.

TABLE XIV.—*Arrangement of the varieties of corn with their pollen-bearing standards.*

Variety receiving pollen.		Ear No. of sire.	
Ears Nos.—	Name.	Marlboro Prolific.	Rodgers White Dent.
1 to 10.....	Aldrich Perfection.....	8	22
1 to 10.....	Cocks Prolific.....	9	24
1 to 10.....	Marlboro Prolific.....	3	7
1 to 10.....	Mosby Prolific.....	2	2
1 to 10.....	Native of Statesboro.....	3	3
1 to 10.....	Rodgers White Dent.....	7	20
1 to 10.....	Sanders Prolific.....	1	1
1 to 10.....	Station Yellow.....	5	15
1 to 10.....	Tindal.....	10	14
1 to 10.....	Whelchel.....	4	4
1 to 10.....	Williamson.....	6	17

CHARACTER OF THE SOIL.

The crossing was accomplished in 1909 at Statesboro, Ga., on coastal plain sand. The soil where the Marlboro Prolific sire was used had a fairly compact, sandy, clay subsoil 10 to 12 inches below the surface, and the land was fairly fertile. The soil where the Rodgers White Dent sire was used had less clay in the subsoil, and the land was naturally less fertile.

CULTURE.

The land was plowed deep. No commercial fertilizer was applied direct to the corn where Marlboro Prolific was used as sire, the land having previously been fertilized for rape. A complete fertilizer at the rate of about 800 pounds per acre was applied to the land where the Rodgers sire was used. The land was listed with a turning plow, and the corn was planted in the bottom of the furrows. Eight square feet were allowed each plant, the rows being 4 feet apart each way. The cultivation was with sweeps and harrows, and the last cultivation left the land level.

HARVEST.

The corn was harvested when thoroughly dry in the field. The weights were taken separately of all ears grown on the standard or sire stalks and of all the ears grown on the detasseled stalks of a row, and the two weights were recorded separately. Only normal hills with normal surroundings were considered, and the number of these hills considered was recorded under the heading "Number of perfect hills."

WORK OF 1910.

Only a portion of the seed from the original ears of this experiment was planted in 1909. The remnant seed of each ear was preserved in a separate glass bottle at Washington, D. C., until the spring of 1910, when it was tested for germination and planted in comparison with crossed progeny that had been growing at Statesboro in 1909, as previously described.

VITALITY OF SEED TESTED BEFORE PLANTING.

Vitality tests were made by the Seed Laboratory of the United States Department of Agriculture of all the ears planted in the experiment. Each ear was represented in the germination test by 10 kernels from various parts of the ear. The results were recorded as so many kernels germinating strong and so many germinating weak. The pure or 2-year-old seed averaged about 90 per cent strong the spring of 1910, and was unusually uniform in this particular, but the vitality of the crossed seed was usually low, and in some cases it was impossible to obtain satisfactory seed, even though the best was chosen. The crossed progeny was represented by a single ear selected largely because its vitality was the best available.

Table XV shows the variability in the germinating power both within the variety and between the varieties.

TABLE XV.—*Germination record of 11 varieties of corn cross-fertilized with Marlboro Prolific pollen.*

Name of variety and character of germination.	Nos. of ears tested.										Average of 10 ears.
	1	2	3	4	5	6	7	8	9	10	
Aldrich Perfection:											
Strong.....	0	3	4	5	0	8	5	5	5	7	4.2
Weak.....	8	3	4	5	9	2	3	1	2	3	4.0
Cocks Prolific:											
Strong.....	9	10	10	5	8	5	9	8	10	5	7.9
Weak.....	1	0	0	4	2	4	1	2	0	5	1.9
Marlboro Prolific:											
Strong.....	10	8	4	6	7	6	10	10	10	8	7.9
Weak.....	0	2	5	3	3	3	0	0	0	2	1.8
Mosby Prolific:											
Strong.....	10	9	8	8	8	8	7	8	10	5	8.5
Weak.....	0	1	2	2	1	0	2	2	0	5	1.1
Native of Statesboro:											
Strong.....	10	10	10	7	10	10	5	7	7	8	8.4
Weak.....	0	0	0	3	0	0	5	3	3	2	1.6
Rodgers White Dent:											
Strong.....	9	9	10	10	10	10	9	10	10	8	9.5
Weak.....	1	1	0	0	0	0	1	0	0	2	.5
Sanders Prolific:											
Strong.....	5	7	10	8	9	3	5	0	2	4	5.3
Weak.....	2	1	0	1	1	4	5	10	7	5	3.6
Station Yellow:											
Strong.....	10	1	6	8	7	10	8	10	6	4	7.0
Weak.....	0	9	4	1	3	0	2	0	3	5	2.7
Tindal:											
Strong.....	8	10	9	10	10	9	10	8	8	10	9.2
Weak.....	2	0	1	0	0	1	0	0	2	0	.6
Whelchel:											
Strong.....	2	0	0	5	3	7	0	3	3	0	2.3
Weak.....	7	5	9	5	6	3	7	4	7	10	6.3
Williamson:											
Strong.....	10	10	10	5	10	5	6	9	4	9	7.8
Weak.....	0	0	0	2	0	5	3	0	6	0	1.6

An unusual quantity of this seed was planted in each hill and later thinned to the stand desired. When the corn came up and started to grow, the vigor of the crossed and of the uncrossed plants was not noticeably different. The productiveness of the female parents in comparison with the first-generation crosses was tested at Statesboro, and upon the same farm where the crosses were produced the previous year, but in a different field. The field had been brought into cultivation more recently than those used in 1909, and although not rich it was quite uniformly fertile.

The seed was planted in hills, and two stalks were left to the hill. The stalks stood from 6 to 8 inches apart in the hill. The first member of each hill in a row was from the remnant seed, and the second member of the hill was progeny of the first, which had been cross-pollinated the previous year.

PLAN OF TESTING PRODUCTIVENESS IN 1910.

Diagram 2 shows the arrangement of this 1910 planting. The varieties were planted in alphabetical order, and their ears in numerical order. As shown in the plan, each hill, for example, of row 1 in section 1 contained two stalks; the first stalk was from original ear 1 of Aldrich Perfection, and the second stalk from an ear descending directly from ear 1 of Aldrich Perfection, and which was cross-pollinated in 1909 with pollen from Rodgers White Dent.

DIAGRAM 2.—Plan of testing plate for comparing the productiveness in 1910 of original pure-bred ears of corn and their crossbred progeny ears.

[Key to the varieties and their crossbred progeny (10 ears of each and 10 rows of each except of *T*): *A*, Aldrich Perfection and its cross with Rodgers White Dent; *B*, Aldrich Perfection and its cross with Marlboro Prolific; *C*, Cocke Prolific and its cross with Rodgers White Dent; *D*, Cocke Prolific and its cross with Marlboro Prolific; *E*, Marlboro Prolific and its cross with Rodgers White Dent; *F*, Marlboro Prolific and its cross with Marlboro Prolific; *G*, Mosby Prolific and its cross with Rodgers White Dent; *H*, Mosby Prolific and its cross with Marlboro Prolific; *I*, Native of Statesboro and its cross with Rodgers White Dent; *J*, Native of Statesboro and its cross with Marlboro Prolific; *K*, Rodgers White Dent and its cross with Rodgers White Dent; *L*, Rodgers White Dent and its cross with Marlboro Prolific; *M*, Sanders Prolific and its cross with Rodgers White Dent; *N*, Sanders Prolific and its cross with Marlboro Prolific; *O*, Station Yellow and its cross with Rodgers White Dent; *P*, Station Yellow and its cross with Marlboro Prolific; *Q*, Tindal and its cross with Rodgers White Dent; *R*, Tindal and its cross with Marlboro Prolific; *S*, Wheelchel and its cross with Rodgers White Dent; *T*, Wheelchel and its cross with Marlboro Prolific (17 rows); *U*, Williamson and its cross with Rodgers White Dent; *V*, Williamson and its cross with Marlboro Prolific.]

Section 1.	Section 2.	Section 3.	Section 4.	Section 5.	Section 6.	Section 7.
$\begin{matrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \\ A \end{matrix}$	$\begin{matrix} 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \\ D \end{matrix}$	$\begin{matrix} 5 & 6 & 7 & 8 & 9 & 10 \\ G \end{matrix}$	$\begin{matrix} 7 & 8 & 9 & 10 \\ J \end{matrix}$	$\begin{matrix} 9 & 10 \\ M \end{matrix}$	$\begin{matrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \\ Q \end{matrix}$	$\begin{matrix} 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \\ T \end{matrix}$
$\begin{matrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \\ B \end{matrix}$	$\begin{matrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \\ E \end{matrix}$	$\begin{matrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \\ H \end{matrix}$	$\begin{matrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \\ K \end{matrix}$	$\begin{matrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \\ N \end{matrix}$	$\begin{matrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \\ R \end{matrix}$	$\begin{matrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \\ U \end{matrix}$
$\begin{matrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \\ C \end{matrix}$	$\begin{matrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \\ F \end{matrix}$	$\begin{matrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \\ I \end{matrix}$	$\begin{matrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \\ L \end{matrix}$	$\begin{matrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \\ O \end{matrix}$	$\begin{matrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \\ S \end{matrix}$	$\begin{matrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \\ V \end{matrix}$
$\begin{matrix} 1 & 2 & 3 & 4 \\ D \end{matrix}$	$\begin{matrix} 1 & 2 & 3 & 4 \\ G \end{matrix}$	$\begin{matrix} 1 & 2 & 3 & 4 & 5 & 6 \\ J \end{matrix}$	$\begin{matrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 \\ M \end{matrix}$	$\begin{matrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \\ P \end{matrix}$	$\begin{matrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \\ T \end{matrix}$	$\begin{matrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \\ W \end{matrix}$

North.

Tenant's cabin $\square$

1 The land at the south end of section 7 was unusually rich, and the stand was made thinner because of chickens of near-by tenant.

CONDITIONS FOR GROWTH.

The land had been thoroughly plowed several weeks previous to planting. Just before planting, furrows were opened with a large shovel, which not only permitted planting below the level in moist earth, but also helped to throw to one side hidden obstructions that might interfere with a uniform thrust of the hand planters used.

A marked wire was used to regulate both the spacing of the hills in the row and the spacing of the stalks in the hills.

The writer and his assistant planted all of the seed. Each man carried seed for a certain member of the hill only, and together they planted each hill. On removing the planter from the ground the foot was placed upon the spot and the weight of the body was thrown upon it in stepping forward to the next hill. Care was taken to remove trash or any other obstruction that might interfere with proper planting.

Nine square feet per plant were allowed, so that very little competition for sunlight was possible among the plants. The rainfall was abundant except for a week or 10 days previous to tasseling. A liberal supply of commercial fertilizer was used.

Abnormal growth (barrenness, smut, etc.) was very rare among the plants, but there were missing members of some hills and a few missing hills. However, in securing the data that follow, consideration was taken only of hills that grew under normal conditions and whose members seemed to have had equal opportunity and were normal.

MANNER OF HARVESTING.

The harvesting was done by four men. One carried a notebook and kept all of the records. Another carried a knife and selected and cut the hills of a row that were suitable. The other two men took the stalks as they were cut, one carrying the first member only and the other carrying the second member only.

The fodder was thus collected and carried to the end of the rows and there weighed, and the collective weights of the two members of each hill were recorded separately.

The ears were then separated from the stover, and the weight of each together with the number of ears was recorded.

MOISTURE IN GRAIN HARVESTED.

Through the courtesy of the Office of Grain Standardization moisture determinations were obtained of grain shelled from many ears of each variety and each cross. The extreme variation among the varieties and crosses was less than 2 per cent of moisture. The shelled grain of Aldrich Perfection and Whelchel contained 16 per

cent of moisture, and the other varieties and crosses contained about 1 per cent less. The appearance of the large cobs of the Whelchel and Aldrich Perfection varieties and the rotting of the ears indicated that the entire ears of these varieties contained a greater excess of moisture than did the shelled grain. In these two cases a correction for moisture content would give a more valuable comparison, but since the moisture content of the entire ears was not determined the comparisons of productiveness are in all cases based on the weight of ears as harvested.

PRESENTATION OF RESULTS IN GEORGIA.

DATA COLLECTED AT HARVEST.

Table XVI gives in detail the data collected at harvest time in 1910.

TABLE XVI.—Yield record of 11 varieties of corn and their crossed progeny tested at Statesboro, Ga.

ALDRICH PERFECTION ♀ × MARLBORO PROLIFIC ♂.¹

Seed ear No.	Number of perfect hills.	Kind of product.	Weight of product (pounds).					Per cent of difference.	Number of ears produced.	
			Total.		Per stalk.				Original.	Cross.
			Original.	Cross.	Original.	Cross.	Difference.			
1	14	Ears.....	9.75	9.50	0.70	0.68	—0.02	— 3	15	14
		Stalks.....	13.75	14.25	.98	1.02	.04	4		
2	8	Ears.....	4.25	5.00	.53	.63	.10	18	8	7
		Stalks.....	6.25	8.25	.78	1.03	.25	32		
3	12	Ears.....	5.75	7.25	.48	.60	.12	26	12	12
		Stalks.....	8.75	11.50	.73	.96	.23	31		
4	19	Ears.....	11.00	11.50	.58	.61	.03	5	20	19
		Stalks.....	15.25	17.25	.80	.91	.11	13		
5	12	Ears.....	6.75	7.75	.56	.65	.09	15	13	12
		Stalks.....	10.00	11.50	.83	.96	.13	15		
6	14	Ears.....	4.25	8.50	.30	.61	.31	100	14	14
		Stalks.....	17.00	12.75	1.21	.91	— .30	— 25		
7	13	Ears.....	8.50	6.75	.65	.52	— .13	— 21	13	13
		Stalks.....	16.25	10.25	1.25	.79	— .46	— 37		
8	8	Ears.....	5.00	5.00	.63	.63	.00	0	8	8
		Stalks.....	8.00	7.50	1.00	.94	— .06	— 6		
9	16	Ears.....	4.50	7.25	.28	.45	.17	61	16	16
		Stalks.....	15.75	12.25	.98	.77	— .21	— 22		
10	16	Ears.....	8.75	8.00	.55	.50	— .05	— 9	16	16
		Stalks.....	13.00	11.25	.81	.70	— .11	— 13		

¹ Favoring the cross: Ears, 6 out of 10; stalks, 5 out of 10. Average weight of ears per stalk produced by the female parent, 0.52 pound; by the cross, 0.58 pound. Average weight of stover per stalk produced by female parent, 0.94 pound; by the cross, 0.88 pound. Increased yield of cross over the female parent: Grain, 12 per cent; stover, —6 per cent.

TABLE XVI.—Yield record of 11 varieties of corn and their crossed progeny tested at Statesboro, Ga.—Continued.

ALDRICH PERFECTION ♀ × RODGERS WHITE DENT ♂.¹

Seed ear No.	Number of perfect hills.	Kind of product.	Weight of product (pounds).					Per cent of difference.	Number of ears produced.	
			Total.		Per stalk.				Original.	Cross.
			Original.	Cross.	Original.	Cross.	Difference.			
1	14	Ears.....	8.00	6.25	0.57	0.45	-0.12	- 22	14	14
		Stalks.....	9.50	12.50	.68	.89	.21	32		
2	21	Ears.....	11.25	13.00	.54	.62	.08	16	21	21
		Stalks.....	17.25	20.25	.82	.96	.14	17		
3	8	Ears.....	3.25	5.00	.41	.63	.22	54	8	9
		Stalks.....	7.25	8.00	.91	1.00	.09	10		
4	24	Ears.....	13.25	13.25	.55	.55	.00	0	24	25
		Stalks.....	19.50	21.00	.81	.88	.07	8		
5	14	Ears.....	7.25	8.00	.52	.57	.05	10	14	15
		Stalks.....	11.00	12.50	.79	.89	.10	14		
6	18	Ears.....	8.50	11.50	.47	.64	.17	35	18	20
		Stalks.....	14.00	16.75	.78	.93	.15	20		
7	15	Ears.....	9.25	9.75	.62	.65	.03	5	15	19
		Stalks.....	14.50	16.00	.97	1.07	.10	10		
8	17	Ears.....	9.25	11.00	.54	.65	.11	19	17	17
		Stalks.....	14.75	17.75	.87	1.04	.17	20		
9	8	Ears.....	3.75	5.25	.47	.66	.19	40	8	10
		Stalks.....	6.25	8.00	.78	1.00	.22	28		
10	12	Ears.....	7.50	6.75	.63	.56	- .07	-10	12	12
		Stalks.....	10.75	10.50	.90	.88	- .02	- 2		

COCKE PROLIFIC ♀ × MARLBORO PROLIFIC ♂.²

1	22	Ears.....	10.25	10.50	0.47	0.48	0.01	2	26	24
		Stalks.....	17.25	16.00	.78	.73	-.05	-7		
2	18	Ears.....	10.50	10.50	.58	.58	.00	0	20	23
		Stalks.....	16.00	15.75	.80	.88	.01	-2		
3	21	Ears.....	9.00	10.00	.43	.48	.05	11	21	23
		Stalks.....	13.00	14.25	.62	.68	.06	10		
4	20	Ears.....	10.00	8.75	.50	.44	-.06	-13	21	20
		Stalks.....	16.50	13.50	.83	.68	-.15	-18		
5	18	Ears.....	10.50	10.25	.58	.57	-.01	-2	25	25
		Stalks.....	16.00	14.75	.80	.82	-.07	-8		
6	23	Ears.....	10.75	13.50	.47	.59	.12	26	29	28
		Stalks.....	17.25	20.50	.75	.89	.14	19		
7	24	Ears.....	11.75	12.50	.40	.52	.03	6	27	25
		Stalks.....	20.25	19.25	.84	.80	-.04	-5		
8	19	Ears.....	11.00	12.00	.58	.63	.05	9	24	28
		Stalks.....	17.00	17.25	.89	.91	.02	1		
9	21	Ears.....	9.00	12.50	.43	.60	.17	39	21	30
		Stalks.....	14.50	19.75	.60	.94	.25	36		
10	18	Ears.....	11.00	11.75	.61	.65	.04	7	28	23
		Stalks.....	18.25	17.50	1.01	.97	-.04	-4		

¹ Favoring the cross: Ears, 7 out of 10; stalks, 9 out of 10. Average weight of ears per stalk produced by the female parent, 0.54 pound; by the cross, 0.59 pound. Average weight of stover per stalk produced by female parent, 0.83 pound; by the cross, 0.95 pound. Increased yield of cross over the female parent: Grain, 10 per cent; stover, 15 per cent.

² Favoring the cross: Ears, 7 out of 10; stalks, 4 out of 10. Average weight of ears per stalk produced by the female parent, 0.51 pound; by the cross, 0.55 pound. Average weight of stover per stalk produced by female parent, 0.81 pound; by the cross, 0.83 pound. Increased yield of cross over the female parent: Grain, 8 per cent; stover, 2 per cent.

TABLE XVI.—Yield record of 11 varieties of corn and their crossed progeny tested at Statesboro, Ga.—Continued.

COCKE PROLIFIC ♀ × RODGERS WHITE DENT ♂.¹

Seed ear No.	Number of perfect hills.	Kind of product.	Weight of product (pounds).					Per cent of difference.	Number of ears produced.	
			Total.		Per stalk.				Original.	Cross.
			Original.	Cross.	Original.	Cross.	Difference.			
1	13	Ears.....	6.75	5.75	0.52	0.44	-0.08	-15	13	13
		Stalks.....	12.00	9.25	.92	.71	-.21	-23		
2	18	Ears.....	9.25	10.00	.51	.56	.05	8	18	20
		Stalks.....	14.00	14.50	.78	.81	.03	4		
3	21	Ears.....	9.00	10.00	.43	.48	.05	11	22	22
		Stalks.....	12.75	15.25	.61	.73	.12	20		
4	18	Ears.....	8.25	7.00	.46	.39	-.07	-15	20	18
		Stalks.....	14.25	10.00	.79	.56	-.23	-30		
5	12	Ears.....	5.75	4.25	.48	.35	-.13	-26	13	12
		Stalks.....	8.75	6.25	.73	.52	-.21	-29		
6	14	Ears.....	6.25	6.75	.45	.48	.03	8	16	14
		Stalks.....	9.75	9.25	.70	.66	-.04	-5		
7	21	Ears.....	10.25	10.50	.49	.50	.01	2	22	21
		Stalks.....	16.25	15.25	.77	.73	-.04	-6		
8	23	Ears.....	11.75	13.75	.51	.60	.09	17	28	31
		Stalks.....	17.00	19.50	.74	.85	.11	15		
9	21	Ears.....	9.00	9.50	.43	.45	.02	6	25	22
		Stalks.....	14.50	16.00	.69	.76	.07	10		
10	15	Ears.....	6.50	7.25	.43	.48	.05	12	16	17
		Stalks.....	9.25	10.50	.62	.70	.08	14		

MARLBORO PROLIFIC ♀ × MARLBORO PROLIFIC ♂.²

1	21	Ears.....	10.75	11.00	0.51	0.52	0.01	2	27	27
		Stalks.....	19.00	17.25	.90	.82	-.08	-9		
2	18	Ears.....	9.25	11.50	.51	.64	.13	24	19	25
		Stalks.....	14.50	18.75	.81	1.04	.23	29		
3	21	Ears.....	11.00	12.00	.52	.57	.05	9	25	28
		Stalks.....	18.50	21.25	.88	1.01	.13	15		
4	20	Ears.....	10.75	8.00	.54	.40	-.14	-26	22	30
		Stalks.....	16.25	13.25	.81	.66	-.15	-18		
5	15	Ears.....	7.75	6.50	.52	.43	-.09	-16	20	16
		Stalks.....	13.25	11.25	.88	.75	-.13	-15		
6	19	Ears.....	9.00	10.00	.47	.53	.06	11	23	22
		Stalks.....	13.50	15.25	.71	.80	.09	13		
7	22	Ears.....	9.75	12.25	.44	.56	.12	26	26	33
		Stalks.....	15.25	19.25	.69	.88	.19	26		
8	25	Ears.....	11.50	14.25	.46	.57	.11	24	29	38
		Stalks.....	19.50	21.75	.78	.87	.09	12		
9	23	Ears.....	12.25	10.75	.53	.47	-.06	-12	30	26
		Stalks.....	19.00	17.00	.83	.74	-.09	-11		
10	23	Ears.....	10.00	9.25	.43	.40	-.03	-8	27	24
		Stalks.....	16.00	13.75	.70	.60	-.10	-14		

¹ Favoring the cross: Ears, 7 out of 10; stalks, 5 out of 10. Average weight of ears per stalk produced by the female parent, 0.47 pound; by the cross, 0.48 pound. Average weight of stover per stalk produced by female parent, 0.73 pound; by the cross, 0.71 pound. Increased yield of cross over the female parent: Grain, 2 per cent; stover, 2 per cent.

² Favoring the cross: Ears, 6 out of 10; stalks, 5 out of 10. Average weight of ears per stalk produced by the female parent, 0.49 pound; by the cross, 0.51 pound. Average weight of stover per stalk produced by female parent, 0.80 pound; by the cross, 0.82 pound. Increased yield of cross over the female parent: Grain, 3 per cent; stover, 2 per cent.

TABLE XVI.—Yield record of 11 varieties of corn and their crossed progeny tested at Statesboro, Ga.—Continued.

MARLBORO PROLIFIC ♀ × RODGERS WHITE DENT ♂¹

Seed ear No.	Number of perfect hills.	Kind of product.	Weight of product (pounds).					Per cent of difference.	Number of ears produced.	
			Total.		Per stalk.				Original.	Cross.
			Original.	Cross.	Original.	Cross.	Difference.			
1	25	Ears.....	14.50	13.25	0.58	0.53	—0.05	— 9	33	28
		Stalks.....	26.50	25.25	1.06	1.01	— .05	— 5		
2	26	Ears.....	12.50	14.00	.48	.54	.06	12	28	27
		Stalks.....	21.00	25.00	.81	.96	.15	19		
3	22	Ears.....	11.50	12.00	.52	.55	.03	4	29	27
		Stalks.....	19.75	23.25	.90	1.06	.16	18		
4	25	Ears.....	14.50	15.00	.58	.60	.02	3	37	27
		Stalks.....	26.25	26.75	1.05	1.07	.02	2		
5	22	Ears.....	12.00	13.00	.55	.59	.04	8	27	28
		Stalks.....	21.00	23.00	.95	1.05	.10	10		
6	21	Ears.....	11.00	12.00	.52	.57	.05	9	28	23
		Stalks.....	18.50	21.00	.88	1.00	.12	14		
7	24	Ears.....	10.75	13.50	.45	.56	.11	26	29	28
		Stalks.....	19.00	23.50	.79	.98	.19	24		
8	21	Ears.....	12.00	11.75	.57	.56	— .01	— 2	29	22
		Stalks.....	22.00	19.50	1.05	.93	— .12	—11		
9	18	Ears.....	10.50	10.50	.58	.58	.00	0	22	20
		Stalks.....	17.00	17.25	.94	.96	.02	1		
10	15	Ears.....	7.50	10.00	.50	.67	.17	33	15	22
		Stalks.....	12.75	15.75	.85	1.05	.20	24		

MOSBY PROLIFIC ♀ × MARLBORO PROLIFIC ♂²

1	25	Ears.....	12.00	13.75	0.48	0.55	0.07	15	35	34
		Stalks.....	21.00	22.75	.84	.91	.07	8	.....	.....
2	20	Ears.....	12.50	13.00	.63	.65	.02	4	34	30
		Stalks.....	20.00	20.00	1.00	1.00	.00	0	.....	.....
3	19	Ears.....	8.00	10.00	.42	.53	.11	25	24	25
		Stalks.....	14.50	16.50	.76	.87	.11	14	.....	.....
4	19	Ears.....	8.75	9.50	.46	.50	.04	9	20	20
		Stalks.....	14.25	15.50	.75	.82	.07	9	.....	.....
5	20	Ears.....	9.00	11.75	.45	.59	.14	31	22	26
		Stalks.....	15.50	18.25	.78	.91	.13	18	.....	.....
6	16	Ears.....	7.75	9.25	.48	.58	.10	19	19	18
		Stalks.....	13.75	14.75	.86	.92	.06	7	.....	.....
7	17	Ears.....	8.25	9.00	.49	.53	.04	9	19	18
		Stalks.....	14.00	14.00	.82	.82	.00	0	.....	.....
8	13	Ears.....	8.00	8.75	.62	.67	.05	9	18	19
		Stalks.....	13.75	15.25	1.06	1.17	.11	11	.....	.....
9	17	Ears.....	8.75	9.00	.51	.53	.02	3	18	23
		Stalks.....	15.00	14.00	.88	.82	— .06	— 7	.....	.....
10	23	Ears.....	9.00	10.00	.39	.43	.04	11	23	25
		Stalks.....	18.00	18.00	.78	.78	.00	0	.....	.....

¹ Favoring the cross: Ears, 7 out of 10; stalks, 8 out of 10. Average weight of ears per stalk produced by the female parent, 0.53 pound; by the cross, 0.57 pound. Average weight of stover per stalk produced by female parent, 0.93 pound; by the cross, 1.01 pounds. Increased yield of cross over the female parent: Grain, 7 per cent; stover, 8 per cent.

² Favoring the cross: Ears, 10 out of 10; stalks, 6 out of 10. Average weight of ears per stalk produced by the female parent, 0.49 pound; by the cross, 0.55 pound. Average weight of stover per stalk produced by female parent, 0.85 pound; by the cross, 0.89 pound. Increased yield of cross over the female parent: Grain, 13 per cent; stover, 6 per cent.

TABLE XVI.—Yield record of 11 varieties of corn and their crossed progeny tested at Statesboro, Ga.—Continued.

MOSEY PROLIFIC ♀ × RODGERS WHITE DENT ♂¹

Seed ear No.	Number of perfect hills.	Kind of product.	Weight of product (pounds).					Per cent of difference.	Number of ears produced.	
			Total.		Per stalk.				Original.	Cross.
			Original.	Cross.	Original.	Cross.	Difference.			
1	18	Ears.....	6.75	10.00	0.38	0.56	0.18	48	25	23
		Stalks.....	13.00	15.75	.72	.88	.16	21	18	20
2	17	Ears.....	6.75	8.25	.40	.49	.09	22	9	31
		Stalks.....	11.25	12.25	.66	.72	.06	43	27	31
3	22	Ears.....	8.75	12.50	.40	.57	.17	37	21	22
		Stalks.....	14.75	20.25	.67	.92	.25	28	22	27
4	18	Ears.....	9.00	11.50	.50	.64	.14	28	22	27
		Stalks.....	14.50	18.50	.81	1.03	.22	29	22	27
5	22	Ears.....	8.50	11.00	.39	.50	.11	25	23	27
		Stalks.....	14.25	17.50	.65	.80	.15	35	23	27
6	20	Ears.....	8.50	11.50	.43	.58	.15	22	25	27
		Stalks.....	14.75	18.00	.74	.90	.16	24	31	26
7	22	Ears.....	10.25	12.75	.47	.58	.11	19	22	22
		Stalks.....	17.25	20.50	.78	.93	.15	10	28	29
8	23	Ears.....	10.25	13.00	.45	.57	.12	12	8	22
		Stalks.....	19.50	21.75	.85	.95	.10	10	28	29
9	18	Ears.....	10.00	10.75	.56	.60	.04	8	28	29
		Stalks.....	16.75	18.50	.93	1.03	.10	15		
10	25	Ears.....	10.75	13.75	.43	.55	.12			
		Stalks.....	20.25	23.25	.81	.93	.12			

NATIVE OF STATESBORO ♀ × MARLBORO PROLIFIC ♂²

1	21	Ears.....	13.25	12.75	0.63	0.61	-0.02	-4	22	23
		Stalks.....	21.25	20.00	1.01	.95	-.06	-6	21	22
2	20	Ears.....	10.75	11.50	.54	.58	.04	7	7	8
		Stalks.....	17.50	18.00	.88	.90	.02	3	24	25
3	7	Ears.....	3.25	3.25	.46	.46	.00	0	17	21
		Stalks.....	5.50	5.00	.79	.71	-.08	-9	16	14
4	23	Ears.....	11.25	12.25	.49	.53	.04	9	14	14
		Stalks.....	18.75	21.50	.82	.93	.11	15	15	16
5	21	Ears.....	9.00	10.50	.43	.50	.07	17	11	15
		Stalks.....	15.25	17.75	.73	.85	.12	16	13	14
6	13	Ears.....	7.00	6.75	.54	.52	-.02	-4	8	8
		Stalks.....	11.00	11.50	.85	.88	.03	5		
7	15	Ears.....	7.25	7.00	.48	.47	-.01	-3		
		Stalks.....	11.25	11.00	.75	.73	-.02	-2		
8	10	Ears.....	6.00	6.25	.60	.63	.03	4		
		Stalks.....	10.00	10.50	1.00	1.05	.05	5		
9	18	Ears.....	7.75	10.00	.43	.56	.13	29		
		Stalks.....	13.25	15.25	.74	.85	.11	15		
10	13	Ears.....	6.75	7.00	.52	.54	.02	4		
		Stalks.....	9.75	10.50	.75	.81	.06	8		

¹ Favoring the cross: Ears, 10 out of 10; stalks, 10 out of 10. Average weight of ears per stalk produced by the female parent, 0.44 pound; by the cross, 0.56 pound. Average weight of stover per stalk produced by female parent, 0.76 pound; by the cross, 0.91 pound. Increased yield of cross over the female parent: Grain, 28 per cent; stover, 19 per cent.

² Favoring the cross: Ears, 6 out of 10; stalks, 7 out of 10. Average weight of ears per stalk produced by the female parent, 0.51 pound; by the cross, 0.54 pound. Average weight of stover per stalk produced by female parent, 0.83 pound; by the cross, 0.88 pound. Increased yield of cross over the female parent: Grain, 6 per cent; stover, 6 per cent.

TABLE XVI.—Yield record of 11 varieties of corn and their crossed progeny tested at Statesboro, Ga.—Continued.

NATIVE OF STATESBORO ♀ × RODGERS WHITE DENT ♂¹

Seed ear No.	Number of perfect hills.	Kind of product.	Weight of product (pounds).					Per cent of difference.	Number of ears produced.	
			Total.		Per stalk.				Original.	Cross.
			Original.	Cross.	Original.	Cross.	Difference.			
1	15	Ears.....	9.80	7.50	0.63	0.50	-0.13	-21	17	15
		Stalks.....	15.50	12.75	1.03	.85	-.18	-18		
2	18	Ears.....	10.75	11.00	.60	.61	.01	2	19	22
		Stalks.....	18.75	18.50	1.04	1.03	-.01	-1		
3	11	Ears.....	7.25	7.25	.66	.66	.00	0	12	14
		Stalks.....	12.25	12.25	1.11	1.11	.00	0		
4	12	Ears.....	7.00	6.00	.58	.50	-.08	-14	12	12
		Stalks.....	12.25	9.50	1.02	.79	-.23	-22		
5	17	Ears.....	9.50	10.50	.56	.62	.06	11	17	17
		Stalks.....	16.50	17.50	.97	1.03	.06	6		
6	11	Ears.....	5.50	6.00	.50	.55	.05	9	12	11
		Stalks.....	11.50	10.50	1.05	.95	-.10	-9		
7	18	Ears.....	8.00	8.25	.44	.46	.02	5	18	20
		Stalks.....	15.00	14.25	.83	.79	-.04	-5		
8	19	Ears.....	8.25	10.50	.43	.55	.12	27	19	19
		Stalks.....	14.50	18.75	.76	.99	.23	29		
9	22	Ears.....	7.75	12.00	.35	.55	.20	55	23	22
		Stalks.....	14.00	20.50	.64	.93	.29	46		
10	21	Ears.....	9.75	9.75	.46	.46	.00	0	21	21
		Stalks.....	14.25	16.75	.68	.80	.12	18		

RODGERS WHITE DENT ♀ × MARLBORO PROLIFIC ♂²

1	18	Ears.....	10.00	10.75	0.56	0.60	0.04	8	18	24
		Stalks.....	15.50	16.75	.86	.93	.07	8		
2	22	Ears.....	11.50	11.00	.52	.50	-.02	-4	26	22
		Stalks.....	16.75	17.00	.76	.77	.01	1		
3	19	Ears.....	9.75	12.00	.51	.63	.12	23	22	23
		Stalks.....	15.75	19.00	.83	1.00	.17	21		
4	21	Ears.....	12.00	11.75	.57	.56	-.01	-2	28	27
		Stalks.....	17.50	18.75	.83	.89	.06	7		
5	25	Ears.....	11.75	13.00	.47	.52	.05	11	25	30
		Stalks.....	18.25	20.50	.73	.82	.09	12		
6	17	Ears.....	7.50	10.25	.44	.60	.16	37	17	19
		Stalks.....	12.25	15.25	.72	.90	.18	24		
7	22	Ears.....	10.00	10.50	.45	.48	.03	5	22	22
		Stalks.....	15.75	16.75	.72	.76	.04	6		
8	17	Ears.....	9.25	9.25	.54	.54	.00	0	17	19
		Stalks.....	14.50	14.75	.85	.87	.02	2		
9	12	Ears.....	5.25	6.75	.44	.56	.12	28	13	14
		Stalks.....	8.00	11.00	.67	.92	.25	38		
10	17	Ears.....	8.50	9.50	.50	.56	.06	12	19	20
		Stalks.....	13.50	15.00	.79	.88	.09	11		

¹ Favoring the cross: Ears, 6 out of 10; stalks, 4 out of 10. Average weight of ears per stalk produced by the female parent, 0.51 pound; by the cross, 0.54 pound. Average weight of stover per stalk produced by female parent, 0.88 pound; by the cross, 0.92 pound. Increased yield of cross over the female parent: Grain, 7 per cent; stover, 5 per cent.

² Favoring the cross: Ears, 7 out of 10; stalks, 10 out of 10. Average weight of ears per stalk produced by the female parent, 0.50 pound; by the cross, 0.55 pound. Average weight of stover per stalk produced by female parent, 0.73 pound; by the cross, 0.87 pound. Increased yield of cross over the female parent: Grain, 10 per cent; stover, 12 per cent.

TABLE XVI.—Yield record of 11 varieties of corn and their crossed progeny tested at Statesboro, Ga.—Continued.

RODGERS WHITE DENT ♀ × RODGERS WHITE DENT ♂.¹

Seed ear No.	Number of perfect hills.	Kind of product.	Weight of product (pounds).					Per cent of difference.	Number of ears produced.	
			Total.		Per stalk.				Original.	Cross.
			Original.	Cross.	Original.	Cross.	Difference.			
1	11	Ears.....	7.00	5.25	0.64	0.48	—0.16	—25	13	11
		Stalks.....	11.25	8.25	1.02	.75	— .27	—27		
2	23	Ears.....	13.25	11.25	.58	.49	— .09	—15	28	25
		Stalks.....	21.25	17.00	.92	.74	— .18	—20		
3	14	Ears.....	7.25	6.75	.52	.48	— .04	— 7	14	14
		Stalks.....	11.00	10.75	.79	.77	— .02	— 2		
4	22	Ears.....	13.25	13.50	.60	.61	.01	2	31	28
		Stalks.....	21.00	22.00	.95	1.00	.05	5		
5	22	Ears.....	12.50	9.75	.57	.44	— .13	—22	28	25
		Stalks.....	19.75	16.00	.90	.73	— .17	—19		
6	22	Ears.....	10.75	9.75	.49	.44	— .05	— 9	22	22
		Stalks.....	17.50	14.50	.80	.66	— .14	—17		
7	16	Ears.....	8.25	8.25	.52	.52	.00	0	16	18
		Stalks.....	13.50	12.75	.84	.80	— .04	— 6		
8	20	Ears.....	13.50	10.50	.68	.53	— .15	—22	20	21
		Stalks.....	21.25	15.25	1.06	.76	— .30	—28		
9	16	Ears.....	7.50	8.25	.47	.52	.05	10	18	16
		Stalks.....	11.50	13.25	.72	.83	.11	15		
10	20	Ears.....	10.00	11.50	.50	.58	.08	15	22	21
		Stalks.....	15.50	18.25	.78	.91	.13	18		

SANDERS PROLIFIC ♀ × MARLBORO PROLIFIC ♂.²

1	11	Ears.....	6.75	6.00	0.61	0.55	—0.06	—11	12	14
		Stalks.....	12.75	10.25	1.16	.93	— .23	—20	.....	.....
2	21	Ears.....	10.25	13.25	.49	.63	.14	29	21	27
		Stalks.....	15.75	23.75	.75	1.13	.38	51	.....	.....
3	12	Ears.....	8.00	9.00	.67	.75	.08	13	17	17
		Stalks.....	12.00	13.50	1.00	1.13	.13	13	.....	.....
4	16	Ears.....	8.25	8.25	.52	.52	.00	0	17	17
		Stalks.....	13.75	13.50	.86	.84	— .02	— 2	.....	.....
5	19	Ears.....	11.25	11.50	.59	.61	.02	2	25	25
		Stalks.....	19.50	17.75	1.03	.93	— .10	— 9	.....	.....
6	13	Ears.....	7.00	7.25	.54	.56	.02	4	14	18
		Stalks.....	13.00	12.25	1.00	.94	— .06	— 6	.....	.....
7	17	Ears.....	9.75	11.50	.57	.68	.11	18	21	23
		Stalks.....	15.00	17.50	.88	1.03	.15	17	.....	.....
8	22	Ears.....	12.00	10.50	.55	.48	— .07	—13	25	22
		Stalks.....	20.00	20.00	.91	.91	.00	0	.....	.....
9	7	Ears.....	4.00	4.25	.57	.61	.04	6	7	9
		Stalks.....	7.25	6.50	1.04	.93	— .11	—10	.....	.....
10	18	Ears.....	11.00	10.00	.61	.56	— .05	— 9	20	21
		Stalks.....	17.00	15.50	.94	.86	— .08	— 9	.....	.....

¹ Favoring the cross: Ears, 3 out of 10; stalks, 3 out of 10. Average weight of ears per stalk produced by the female parent, 0.56 pound; by the cross, 0.51 pound. Average weight of stover per stalk produced by female parent, 0.88 pound; by the cross, 0.80 pound. Increased yield of cross over the female parent: Grain, —8 per cent; stover, —9 per cent.

² Favoring the cross: Ears, 6 out of 10; stalks, 3 out of 10. Average weight of ears per stalk produced by the female parent, 0.57 pound; by the cross, 0.59 pound. Average weight of stover per stalk produced by female parent, 0.94 pound; by the cross, 0.96 pound. Increased yield of cross over the female parent: Grain, 4 per cent; stover, 3 per cent.

TABLE XVI.—Yield record of 11 varieties of corn and their crossed progeny tested at Statesboro, Ga.—Continued.

SANDERS PROLIFIC ♀ × RODGERS WHITE DENT ♂.¹

Seed ear No.	Number of perfect hills.	Kind of product.	Weight of product (pounds).					Per cent of difference.	Number of ears produced.	
			Total.		Per stalk.				Original.	Cross.
			Original.	Cross.	Original.	Cross.	Difference.			
1	10	Ears.....	4.75	5.00	0.48	0.50	0.02	5	10	11
		Stalks.....	6.75	7.25	.68	.73	.05	7		
2	20	Ears.....	9.50	11.50	.48	.58	.10	21	21	23
		Stalks.....	14.50	18.00	.73	.90	.17	24		
3	15	Ears.....	7.50	10.25	.50	.68	.18	37	16	19
		Stalks.....	12.25	16.00	.82	1.07	.25	31		
4	18	Ears.....	9.75	10.50	.54	.58	.04	8	19	21
		Stalks.....	14.75	18.00	.82	1.00	.18	22		
5	4	Ears.....	2.50	2.25	.63	.56	— .07	—10	5	4
		Stalks.....	5.00	3.50	1.25	.88	— .37	—30		
6	20	Ears.....	10.00	12.50	.50	.63	.13	25	21	23
		Stalks.....	15.00	20.00	.75	1.00	.25	33		
7	15	Ears.....	8.25	8.25	.55	.55	.00	0	20	16
		Stalks.....	11.25	12.25	.75	.82	.07	9		
8	18	Ears.....	10.25	10.25	.57	.57	.00	0	21	21
		Stalks.....	15.00	14.75	.83	.82	— .01	— 2		
9	21	Ears.....	9.50	10.75	.45	.51	.06	13	22	25
		Stalks.....	14.25	17.50	.68	.83	.15	23		
10	23	Ears.....	10.50	12.25	.46	.53	.07	17	24	23
		Stalks.....	16.00	19.25	.70	.84	.14	20		

STATION YELLOW ♀ × MARLBORO PROLIFIC ♂.²

1	19	Ears.....	9.25	13.75	0.49	0.72	0.23	49	20	31
		Stalks.....	15.50	20.50	.82	1.08	.26	32		
2	21	Ears.....	10.25	10.25	.49	.49	.00	0	23	23
		Stalks.....	17.00	16.00	.81	.76	— .05	— 6		
3	15	Ears.....	8.50	7.75	.57	.52	— .05	— 9	19	18
		Stalks.....	14.50	11.75	.97	.78	— .19	—19		
4	17	Ears.....	8.25	8.00	.49	.47	— .02	— 3	18	23
		Stalks.....	13.00	12.50	.76	.74	— .02	— 4		
5	19	Ears.....	8.75	10.50	.46	.55	.09	20	19	23
		Stalks.....	13.00	17.25	.68	.91	.23	33		
6	19	Ears.....	9.00	10.00	.47	.53	.06	11	20	21
		Stalks.....	14.50	15.00	.76	.79	.03	3		
7	12	Ears.....	8.50	6.00	.46	.50	.04	9	12	15
		Stalks.....	8.75	11.00	.73	.92	.19	26		
8	18	Ears.....	10.00	9.75	.56	.54	— .02	— 3	18	18
		Stalks.....	15.25	15.00	.85	.83	— .02	— 2		
9	15	Ears.....	7.50	10.75	.50	.72	.22	43	15	24
		Stalks.....	11.50	15.75	.77	1.05	.28	37		
10	19	Ears.....	10.00	10.50	.53	.55	.02	5	25	23
		Stalks.....	14.75	16.50	.78	.87	.09	12		

¹ Favoring the cross: Ears, 7 out of 10; stalks, 8 out of 10. Average weight of ears per stalk produced by the female parent, 0.50 pound; by the cross, 0.57 pound. Average weight of stover per stalk produced by female parent, 0.76 pound; by the cross, 0.89 pound. Increased yield of cross over the female parent: Grain, 13 per cent; stover, 17 per cent.

² Favoring the cross: Ears, 6 out of 10; stalks, 6 out of 10. Average weight of ears per stalk produced by the female parent, 0.50 pound; by the cross, 0.56 pound. Average weight of stover per stalk produced by female parent, 0.79 pound; by the cross, 0.87 pound. Increased yield of cross over the female parent: Grain, 12 per cent; stover, 10 per cent.

TABLE XVI.—Yield record of 11 varieties of corn and their crossed progeny tested at Statesboro, Ga.—Continued.

STATION YELLOW ♀ × RODGERS WHITE DENT ♂¹

Seed ear No.	Number of perfect hills.	Kind of product.	Weight of product (pounds).					Per cent of difference.	Number of ears produced.	
			Total.		Per stalk.				Original.	Cross.
			Original.	Cross.	Original.	Cross.	Difference.			
1	16	Ears.....	8.25	8.75	0.52	0.55	0.03	6	17	17
		Stalks.....	13.00	14.00	.81	.88	.07	8		
2	22	Ears.....	11.75	15.75	.53	.72	.19	34	24	24
		Stalks.....	20.00	26.50	.91	1.20	.29	33		
3	18	Ears.....	11.00	10.50	.61	.58	-.03	5	20	19
		Stalks.....	19.25	19.50	1.07	1.08	.01	1		
4	19	Ears.....	10.00	11.00	.53	.58	.05	10	23	19
		Stalks.....	16.50	18.25	.87	.96	.09	11		
5	22	Ears.....	9.50	13.25	.43	.60	.17	39	22	26
		Stalks.....	14.00	19.75	.64	.90	.26	41		
6	19	Ears.....	11.25	12.25	.59	.64	.05	9	26	21
		Stalks.....	19.00	19.50	1.00	1.03	.03	3		
7	16	Ears.....	8.75	8.75	.55	.55	.00	0	16	16
		Stalks.....	15.00	16.00	.94	1.00	.06	7		
8	21	Ears.....	11.75	13.50	.56	.64	.08	15	21	21
		Stalks.....	19.25	21.00	.92	1.00	.08	9		
9	20	Ears.....	8.50	10.75	.43	.54	.11	26	20	21
		Stalks.....	13.00	17.50	.65	.88	.23	35		
10	18	Ears.....	8.50	7.75	.47	.43	-.04	9	20	19
		Stalks.....	13.75	12.25	.76	.68	-.08	11		

TINDAL ♀ × MARLBORO PROLIFIC ♂²

1	22	Ears	11.75	12.00	0.53	0.55	0.02	2	30	34
		Stalks	17.50	18.75	.80	.85	.05	7	.....	.....
2	19	Ears	9.50	9.50	.50	.50	.00	0	27	25
		Stalks	14.50	14.75	.76	.78	.02	2	.....	.....
3	23	Ears	12.00	12.00	.52	.52	.00	0	33	32
		Stalks	18.00	18.75	.78	.82	.04	4	.....	.....
4	21	Ears	11.00	12.25	.52	.58	.06	11	30	33
		Stalks	17.75	19.25	.85	.92	.07	8	.....	.....
5	18	Ears	9.50	8.25	.53	.46	-.07	13	26	23
		Stalks	16.25	13.50	.90	.75	-.15	17	.....	.....
6	15	Ears	7.50	7.50	.50	.50	.00	0	19	16
		Stalks	12.50	12.00	.83	.80	-.03	4	.....	.....
7	24	Ears	15.00	11.25	.63	.47	-.16	25	37	26
		Stalks	23.75	18.00	.99	.75	-.24	24	.....	.....
8	17	Ears	9.00	9.75	.53	.57	.04	8	21	21
		Stalks	14.00	15.00	.82	.88	.06	7	.....	.....
9	18	Ears	9.00	8.75	.50	.49	-.01	3	19	19
		Stalks	13.50	13.50	.75	.75	.00	0	.....	.....
10	24	Ears	12.00	12.25	.50	.51	.01	2	33	26
		Stalks	18.00	18.75	.75	.78	.03	4	.....	.....

¹ Favoring the cross: Ears, 7 out of 10; stalks, 9 out of 10. Average weight of ears per stalk produced by the female parent, 0.52 pound; by the cross, 0.59 pound. Average weight of stover per stalk produced by female parent, 0.85 pound; by the cross, 0.96 pound. Increased yield of cross over the female parent: Grain, 13 per cent; stover, 13 per cent.

² Favoring the cross: Ears, 4 out of 10; stalks, 6 out of 10. Average weight of ears per stalk produced by the female parent, 0.53 pound; by the cross, 0.51 pound. Average weight of stover per stalk produced by female parent, 0.82 pound; by the cross, 0.81 pound. Increased yield of cross over the female parent: Grain, -3 per cent; stover, -2 per cent.

TABLE XVI.—Yield record of 11 varieties of corn and their crossed progeny tested at Statesboro, Ga.—Continued.

TINDAL ♀ × RODGERS WHITE DENT ♂.¹

Seed ear No.	Number of perfect hills.	Kind of product.	Weight of product (pounds).					Per cent of difference.	Number of ears produced.	
			Total.		Per stalk.				Original.	Cross.
			Original.	Cross.	Original.	Cross.	Difference.			
1	12	Ears	6.00	5.75	0.50	0.48	-0.02	- 4	18	14
		Stalks	9.25	9.25	.77	.77	.00	0		
2	20	Ears	9.50	10.75	.48	.54	.06	13	26	22
		Stalks	15.75	17.25	.79	.86	.07	10		
3	24	Ears	10.25	12.25	.43	.51	.08	20	29	28
		Stalks	15.00	19.50	.63	.81	.18	30		
4	20	Ears	9.75	10.50	.49	.53	.04	8	26	22
		Stalks	15.25	16.00	.76	.80	.04	5		
5	16	Ears	7.50	8.00	.47	.50	.03	7	17	18
		Stalks	11.75	12.25	.73	.77	.04	4		
6	23	Ears	11.50	14.00	.50	.61	.11	22	27	32
		Stalks	18.75	21.00	.82	.91	.09	12		
7	16	Ears	9.25	8.00	.68	.50	- .08	-14	22	16
		Stalks	14.00	13.00	.88	.81	- .07	- 7		
8	13	Ears	7.00	7.50	.54	.58	.04	7	14	13
		Stalks	10.50	11.25	.81	.87	.06	7		
9	13	Ears	6.50	7.75	.50	.60	.10	19	15	14
		Stalks	10.25	10.50	.79	.81	.02	2		
10	18	Ears	10.00	9.25	.56	.51	- .05	- 8	25	22
		Stalks	14.25	14.75	.79	.82	.03	4		

WHELCHER ♀ × MARLBORO PROLIFIC ♂.²

1	9	Ears.....	4.25	5.25	0.47	0.58	0.11	24	9	9
		Stalks.....	8.00	9.50	.89	1.06	.17	19		
2	8	Ears.....	5.00	4.00	.63	.50	-.13	-20	9	10
		Stalks.....	8.75	8.25	1.09	1.03	-.06	-6		
3	7	Ears.....	4.75	4.25	.68	.61	-.07	-10	8	7
		Stalks.....	8.25	7.50	1.18	1.07	-.11	-9		
4	24	Ears.....	15.75	15.75	.66	.66	.00	0	26	29
		Stalks.....	26.75	27.75	1.11	1.16	.05	4		
5	17	Ears.....	9.75	10.75	.57	.63	.06	10	17	17
		Stalks.....	16.00	19.00	.94	1.12	.18	19		
6	20	Ears.....	12.50	14.75	.63	.74	.11	18	21	26
		Stalks.....	25.00	25.50	1.25	1.28	.03	2		
7	12	Ears.....	9.00	7.75	.75	.65	-.10	-14	12	12
		Stalks.....	16.00	13.00	1.33	1.08	-.25	-19		
8	6	Ears.....	4.50	5.00	.75	.83	.08	11	7	9
		Stalks.....	8.00	7.75	1.33	1.29	-.04	-3		
9	18	Ears.....	11.75	14.00	.65	.78	.13	19	19	23
		Stalks.....	20.75	23.75	1.15	1.32	.17	14		
10	22	Ears.....	15.50	16.50	.70	.75	.05	6	22	29
		Stalks.....	27.50	27.50	1.25	1.25	.00	0		

¹ Favoring the cross: Ears, 7 out of 10; stalks, 8 out of 10. Average weight of ears per stalk produced by the female parent, 0.50 pound; by the cross, 0.54 pound. Average weight of stover per stalk produced by female parent, 0.77 pound; by the cross, 0.83 pound. Increased yield of cross over the female parent: Grain, 7 per cent; stover, 7 per cent.

² Favoring the cross: Ears, 6 out of 10; stalks, 5 out of 10. Average weight of ears per stalk produced by the female parent, 0.65 pound; by the cross, 0.69 pound. Average weight of stover per stalk produced by female parent, 1.15 pounds; by the cross, 1.19 pounds. Increased yield of cross over the female parent: Grain, 6 per cent; stover, 3 per cent.

TABLE XVI.—Yield record of 11 varieties of corn and their crossed progeny tested at Statesboro, Ga.—Continued.

WILLIAMSON ♀ × MARLBORO PROLIFIC ♂.¹

Seed ear No.	Number of perfect hills.	Kind of product.	Weight of product (pounds).					Per cent of difference.	Number of ears produced.	
			Total.		Per stalk.				Original.	Cross.
			Original.	Cross.	Original.	Cross.	Difference.			
1	11	Ears.....	4.50	5.00	0.41	0.45	0.04	11	11	
		Stalks.....	7.00	8.50	.64	.77	.13	21		
2	14	Ears.....	6.50	9.00	.46	.64	.18	38	16	
		Stalks.....	11.75	13.75	.84	.98	.14	17		
3	13	Ears.....	7.25	7.00	.56	.54	-.02	-3	13	
		Stalks.....	11.75	11.50	.90	.88	-.02	-2		
4	13	Ears.....	6.25	6.50	.48	.50	.02	4	14	
		Stalks.....	10.25	9.75	.79	.75	-.04	-5		
5	17	Ears.....	6.50	10.00	.38	.56	.21	54	17	
		Stalks.....	10.50	17.25	.62	1.01	.39	64		
6	17	Ears.....	8.50	8.50	.50	.50	.00	0	18	
		Stalks.....	13.00	13.00	.76	.76	.00	0		

WILLIAMSON ♀ × RODGERS WHITE DENT ♂.²

1	18	Ears.....	8.50	9.50	0.47	0.53	0.06	12	19	21
		Stalks.....	15.50	17.50	.86	.97	.11	13		
2	22	Ears.....	10.75	14.75	.49	.67	.18	37	22	28
		Stalks.....	18.50	25.75	.84	1.17	.33	39		
3	18	Ears.....	10.50	11.00	.58	.61	.03	5	19	20
		Stalks.....	16.75	17.50	.93	.97	.04	4		
4	23	Ears.....	11.50	14.50	.50	.63	.13	26	26	22
		Stalks.....	20.25	26.00	.88	1.13	.25	28		
5	14	Ears.....	6.75	7.50	.48	.54	.06	11	14	15
		Stalks.....	11.25	12.50	.80	.89	.09	11		
6	16	Ears.....	7.00	9.00	.44	.56	.12	29	16	16
		Stalks.....	11.75	15.50	.73	.97	.24	32		
7	6	Ears.....	3.75	3.25	.63	.54	-.09	-13	7	6
		Stalks.....	6.75	5.50	1.13	.92	-.21	-19		
8	8	Ears.....	4.25	5.00	.53	.63	.10	18	9	8
		Stalks.....	6.75	8.25	.84	1.03	.19	22		
9	15	Ears.....	7.75	8.00	.52	.53	.01	3	16	15
		Stalks.....	13.00	13.00	.87	.87	.00	0		
10	15	Ears.....	7.50	6.75	.50	.45	-.05	10	15	15
		Stalks.....	12.00	12.00	.80	.80	.00	0		

¹ Favoring the cross: Ears, 4 out of 6; stalks, 3 out of 6. Average weight of ears per stalk produced by the female parent, 0.46 pound; by the cross, 0.54 pound. Average weight of stover per stalk produced by female parent, 0.76 pound; by the cross, 0.87 pound. Increased yield of cross over the female parent: Grain, 16 per cent; stover, 14 per cent.

² Favoring the cross: Ears, 8 out of 10; stalks, 7 out of 10. Average weight of ears per stalk produced by the female parent, 0.50 pound; by the cross, 0.58 pound. Average weight of stover per stalk produced by female parent, 0.85 pound; by the cross, 0.99 pound. Increased yield of cross over the female parent: Grain, 14 per cent; stover, 16 per cent.

In Table XVII a comparison of the effect of crossing is made between the varieties as a whole, when crossed by Marlboro Prolific and when crossed by Rodgers White Dent. The percentage of increase or decrease in yield of the cross is given, and also the number of rows out of 10 in which the production of the crossed ears was greater than that of the original 2-year-old seed of the female parent grown in the same hills with the cross.

TABLE XVII.—*Summary of the 10 ears of each variety tested with their crossed progeny.*

Female variety.	Marlboro Prolific sire.				Rodgers White Dent sire.			
	Increase of cross over 1908 seed of female parent.		Rows favoring the cross.		Increase of cross over 1908 seed of female parent.		Rows favoring the cross.	
	Ears.	Stalks.	Ears.	Stalks.	Ears.	Stalks.	Ears.	Stalks.
	<i>Percent.</i>	<i>Per cent.</i>			<i>Percent.</i>	<i>Per cent.</i>		
Aldrich Perfection.....	12	— 6	6	5	10	15	7	9
Cocks Prolific.....	8	2	7	4	2	— 2	7	3
Marlboro Prolific.....	3	2	6	5	7	8	7	8
Mosby Prolific.....	13	6	10	6	28	19	10	10
Native of Statesboro.....	6	6	6	7	7	5	6	4
Rodgers White Dent.....	10	12	7	10	— 8	— 9	3	3
Sanders Prolific.....	4	3	6	3	13	17	7	8
Station Yellow.....	12	10	6	6	13	13	7	9
Tindal.....	— 3	— 2	4	6	7	7	7	8
Williamson.....	16	14	14	13	14	16	8	7
General results.....	7	4	6.9	6.1	9	9	6.9	7

¹ Only six rows considered.

Table XVII shows that when crossed with Marlboro Prolific all but one variety (Tindal) gave a gain in ears, and all but two varieties gave a gain in stover. When crossed with Rodgers White Dent all varieties except the sire variety itself gave a gain in ears, and only two gave a loss in stover.

SOME CROSSES SUPERIOR TO EITHER PARENT.

Since the yields of the crosses are compared only with the female parent, it might be concluded that this general higher yield of the crosses is probably due to the still greater productiveness of the male parent. This conclusion, however, is not supported in the cases where Marlboro Prolific and Rodgers White Dent serve as females in the experiment. In both instances the resulting cross produced better than its female parent and since Rodgers White Dent is more productive than Marlboro Prolific, as shown in Table XVII, the cross in which Rodgers White Dent served as female must be considered more productive than either parent.

In Table XVIII is shown the average ranking of the varieties according to their productiveness in 1910 in the test plats at Statesboro, Ga., where each variety was grown in the same hills with its crossed progeny.

TABLE XVIII.—*Arrangement of varieties of corn in the order of their productiveness, as indicated by the average yield per stalk when grown in hills with their crosses.*

Name of variety.	Ears per stalk.	Average rank.	Name of variety.	Ears per stalk.	Average rank.
	<i>Pounds.</i>			<i>Pounds.</i>	
Sanders Prolific.....	0.535	1	Native of Statesboro.....	0.51	4b
Aldrich Perfection.....	.53	2a	Station Yellow.....	.51	4c
Rodgers White Dent.....	.53	2b	Cocks Prolific.....	.49	5
Tindal.....	.515	3	Williamson.....	.48	6
Marlboro Prolific.....	.51	4a	Mosby Prolific.....	.465	7

It will be seen that seven varieties equal or excel Marlboro Prolific. When these seven varieties are crossed with Marlboro Prolific as sire six out of the seven first-generation crosses exceed the Marlboro Prolific in grain production, and five in stover production.

It will also be seen that two varieties equal or excel Rodgers White Dent. When these two varieties are crossed with Rodgers White Dent as sire both of the first-generation crosses exceed the Rodgers White Dent in grain and stover production. It will thus be seen that out of the 20 crosses made 8 have given grain yields greater than the better parent, and 7 have given stover yields greater than the better parent.

RELATION OF THE PRODUCTIVITY OF THE CROSSES TO THE PRODUCTIVITY OF THE PURE STRAINS.

It is a striking point in connection with the foregoing table that all those female varieties giving more productive crosses than either parent are grouped at one end—the upper end—of the ranking list for production and with but one break in the rank. None fall below fourth in production in a total ranking of seven. With one exception the varieties that can not be said to have given advantageous crosses with either sire are grouped at the other or lower end of the ranking list.

Omitting Marlboro Prolific and Rodgers White Dent, nine other varieties are crossed by each of these sires. In six out of the nine comparisons the crosses with Rodgers White Dent are more productive than those with Marlboro Prolific.

In view of these points and the fact that Rodgers White Dent is more productive than Marlboro Prolific it is found that the productiveness of both parents seems to stand out clearly as a factor in influencing high yield in first-generation crosses.

The Tindal variety, however, is a striking exception to this seeming tendency. The rank of this variety is third in productiveness, but when crossed by Marlboro Prolific its yield was actually less than its poorest producing parent; and when crossed by Rodgers White Dent the cross was less productive than that sire.

Because of this exception, this apparent tendency can not be relied upon as a guide in the selection of suitable varieties for practical crossing.

ADAPTATION AS A FACTOR IN THE PRODUCTION OF HIGHER YIELDS THROUGH CROSSING.

As the difference between the lowest and the highest producers is less than 5 bushels per acre, it would seem that it might be questionable to discuss this subject with the data at hand. In justice to the subject, however, it should be stated that the appearance of the corn produced indicated more variability in adaptation than do the weights.

It is interesting to note in this connection that the variety Mosby Prolific is farthest from home, that it has been carried to a more radically different soil than any of the other varieties, and that it is ranked lowest in yield and failed to give a practical cross. Cocke Prolific is the next farthest from home, ranks third from the bottom of the list, and was impractical for crossing with either Marlboro Prolific or Rodgers White Dent. The Williamson corn ranks next to Mosby Prolific; as it had been given considerable selection at home for years, it is reasonable to suppose that its low yield is due to poor adaptation.

It is thus seen that three out of the four varieties that were impractical as crosses with either of the two sires were also poorly adapted to the conditions at Statesboro. The Tindal variety again stands out as an exception.

INFLUENCE OF SEASONAL DIFFERENCES.

In 1909, while the crosses for this test were being grown, a careful comparison of the varieties was made. The season was different from that of 1910, and the effect is clearly shown by the ranking obtained at that time.

The ranking for 1909 was:

First	Tindal.	Sixth	Williamson.
Second	Station Yellow.	Seventh	Mosby Prolific.
Third	Native of Statesboro.	Eighth	Aldrich Perfection.
Fourth	Rodgers White Dent.	Ninth	Cocke Prolific.
Fifth	Marlboro Prolific.	Tenth	Sanders Prolific.

Apparently the difference between the two seasons has resulted in changing Sanders Prolific from last to first in rank and Aldrich Perfection from eighth to second. The first year less difference in production was shown between the two sire varieties than was shown the second year. In 1909 Mosby Prolific (poorest in 1910) ranked better than Aldrich Perfection (second in 1910). Tindal ranked high both years.

The differences shown by the two tests are radical, but hardly more than is frequently found in variety tests of more than one year.

If, as has been previously indicated, there is usually a relation between high yield and adaptation and the advantageous crossing of corn, then it would seem that seasonal differences may play an important part.

INFERENCES DRAWN FROM THE FOREGOING DATA.

From these tests it would seem that the productivity of first-generation crosses is usually correlated to the productivity of the parent varieties, and the yield of the parent varieties is largely dependent upon their adaptation to the location and the season during which the test is made.

As seasonal differences have a marked effect upon the comparative production of varieties the success of a cross one season may be found fleeting if continued.

The fact that the variety Tindal in its adverse performance toward crossing has rather emphatically ignored all the influences of rank and adaptation that seem to govern other varieties may indicate that advantageous exceptions may also be found; but whatever further investigation may demonstrate, present knowledge indicates that the economic increasing of corn yields by means of crossing is attended with many complexities.

GENERAL CONSIDERATION OF ALL THE TESTS.

INDICATIONS OF INTERMEDIACY.

As the varieties crossbred at the various points are varieties that have met with general favor as grain producers, the characters of the male and female parents of each cross are not radically different, and consequently any intermediacy of a cross is not as apparent as it might be if the parents were much unlike. However, in many instances intermediacy between the two parents was observed regarding various characters; such as productiveness, height of stalk, length of growing season, and percentage of moisture.

Averages of many crosses usually indicate intermediacy, because exceptions in one direction from the median points are offset by exceptions in the other direction, but under the conditions of these and other tests of this nature so few instances have been shown in which the first-generation crosses produced less than the average of the two parents as to indicate that the average productiveness of first-generation corn crosses is usually above the average of the parents. It may be that this indication will not be found entirely due to advantages regarding adaptation, age of seed, self-fertilization, etc., that most of the reported tests ¹ have given to the first-generation

¹ Beal, W. J. Reports, Michigan Board of Agriculture, 1876, 1877, 1881, and 1882.

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crosses, and that further work with all conditions more nearly equalized will demonstrate a general tendency for first-generation crosses to produce better than the average of the parents. Such a general tendency might be due to prepotency of the higher yielding parent. It is more profitable to grow the higher yielding parent except in cases in which the first-generation cross produces better than either parent. Since some first-generation crosses are more productive and some are less productive than their better parent, the greatest benefit can be obtained by planting such as may be found more productive than the highest yielding variety of a community.

PERCENTAGE OF MOISTURE IN SHELLED GRAIN OF CROSSES AND
PARENT VARIETIES.

Because of care in allowing the ears of all varieties to dry thoroughly before yields were weighed it has not been necessary to calculate corrections for moisture content except in the Maryland tests. The moisture content of shelled grain from a large number of ears of each variety at each point was determined by the Office of Grain Standardization of the Bureau of Plant Industry. Regarding this character, averages as given in Table XIX show the first-generation crosses to be intermediate between the parents.

TABLE XIX.—*Average percentage of moisture in shelled grain of crosses and parent varieties on dates when yields were weighed.*

Tests.	Female parents.	Male parents.	Average of both parents.	First-gen- eration crosses.
Maryland.....	27.29	28.77	28.03	28.32
California.....	10.22	11.74	10.98	10.90
Texas.....	12.39	11.45	11.92	12.13
Georgia.....	15.40	15.01	15.21	15.00
General average.....	16.33	16.74	16.54	16.59

UNRELIABILITY OF AVERAGES FOR SPECIFIC INSTANCES.

With investigations of this nature the investigators as well as the readers are desirous that the work should discover some law of nature. However, the development and evolution of plants furnish so many exceptions and variations to even general laws that it is impossible to foretell the effects of crossbreeding particular varieties by the effects secured previously from crossbreeding other varieties. Types, varieties, strains, ears, and even kernels of corn contain in their lineage such complexity of structure and characters that it is not surprising that this work, necessarily of a preliminary nature, should unfold more problems than it solves.

The results are interesting because they contain evidence in support of various theories, but the chief value of the work is its indi-

cation of what can be accomplished in the field of research and more especially in establishing methods of producing high-yielding seed corn.

The influences that show with the greatest uniformity in these tests are those of acclimatization and adaptation. The results given here of these influences will be combined in a future publication with results obtained in other localities showing the effects on maize of acclimatization and adaptation. In studying the effects attributable to crossbreeding it is necessary to recognize the effects due both to acclimatization and to adaptation. The distinction between the effects of acclimatization and of adaptation is brought out in the tests of identically the same lots of seed in Maryland and in California. In Maryland, because of their acclimatization and adaptation some varieties produced much better than others of the same growing period which were brought from distant States. None of these varieties were acclimated to California conditions, though some of the earliest maturing, which were least productive in Maryland, were most productive in California. Their early maturity proved an adaptation which enabled them to escape the later and drier part of the summer. In Texas, varieties that have been subjected for years to practically the same climatic conditions indicate different degrees of adaptation to clay soils and to sandy soils.

Tests of this nature thus far reported indicate that first-generation crosses usually produce better than the average of the two parents. It is not certain that this is entirely due to the advantages that these tests have given to the crosses regarding age and vitality of seed, or to the year of adaptation and selection incident to growing the crossbred seed under the same environment in which the test of productiveness was afterwards made, but to which the parent varieties were not adapted. If further tests should show that with all conditions equalized there still exists a tendency for first-generation crosses to produce better than the average of the two parents, it might be taken as an indication that the higher yielding parent is usually prepotent.

A production better than the average of the two parents, unless it be better than the production of either parent, would furnish no practical method of originating strains superior to those already existing, except in cases in which the crossing might originate strains that combine or nick better than previously existing strains. When all influencing factors, such as age and maturity of seed, acclimatization, and adaptation are equal, and the first-generation cross is more productive than either parent, it is a clear instance in which a practical advantage is derived by crossbreeding.

Variations found to apply to varieties are also found to apply to different ears within a variety when they are crossbred and tested separately—in other words, some ears are crossed with another

variety advantageously and some disadvantageously, though in general there is a tendency for the different ears of a variety to respond similarly to the crossing. Another line of work being conducted by the Office of Corn Investigations indicates that what has just been said about the crossing of one variety with another also applies to the crossbreeding of individual plants within a variety. Just as certain pairs of varieties combine or nick advantageously, while other pairs nick disadvantageously, so some pairs of individual plants nick advantageously, while other pairs nick disadvantageously. This shows the results obtained by crossing two varieties without reference to individual plants to be but an average of the results that would be obtained by crossing many individual plants of those varieties. The average results may be an improvement over either parent and still fall short of what could be obtained by restricting the crossing to the individuals that nick most advantageously.

In connection with this consideration of crossbreeding, it is interesting to note that such varieties as Selection 119, Selection 160, and Chisholm, which are among the most profitable varieties for their respective localities, have not been crossbred or mixed with other varieties for many years. The same can be said of leading strains of corn of other localities, and their merits are doubtless largely due to effects of selection, acclimatization, and adaptation.

The results of these tests show that with corn some first-generation crosses are more productive than either parent, that some are intermediate between the two parents in productiveness, and that some are less productive than either parent. They also show that the determination of the particular first-generation crosses that can be most profitably grown is attended with so many complexities that careful tests must be made in a locality before the farmers of that locality can be intelligently advised whether it is to their interest to continue planting a pure-bred strain, or to plant a first-generation cross of certain strains.

In crossbreeding corn for practical results it seems the duty of State experiment stations and of corn breeders to determine what two varieties nick to best advantage in producing seed for different environments. Whether the yearly production of a particular first-generation cross will be found advisable, or whether its use in making other crosses will be found more profitable, must be established by further work, and perhaps for each individual case. Progress in producing higher yielding strains of corn depends upon the proper combination and application of the effects of acclimatization, adaptation, crossbreeding, and selection.

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